INTERFACE AGE™

MICROCOMPUTING FOR HOME AND SMALL BUSINESS VOL. 2, ISSUE 1, DEC. 1976 $1.50

Exploring AMI's 6800 Microcomputer Chip Set

Tiny BASIC For The 8080

Insight Into Cromemco's New ZPU Card

Standard BASIC For The 8080 Part I



EXCLUSIVE

iCOM's New Microfloppy™ Disc System

6800-SOFTWARE

WARNING – It has been determined that reading this ad may be hazardous to your health, if you own another type computer system. We will not be responsible for ulcers, heartburn, or other complications if you persist in reading this material.

4 K BASIC© — 8 K BASIC©

* Full floating point math
* 1.0E-99 to 9.99999999E+99 number range
* User programs may be saved and loaded
* Direct mode provided for most statements
* Will run most programs in 8K bytes of memory (4K Version)
 or 12K bytes of memory (8K Version)
* USER function provided to call machine language programs
* String variables and trig functions–8K BASIC only

COMMANDS

LIST
RUN
NEW
SAVE
LOAD
PATCH

STATEMENTS

REM
DIM
DATA
READ
RESTORE
LET*
FOR
END
GOTO*
ON. . .GOTO*
ON. . .GOSUB*
IF. . .THEN*
INPUT
PRINT*
NEXT
STOP
GOSUB*
PATCH*
RETURN
† DES
† PEEK
† POKE

FUNCTIONS

ABS
INT
RND
SGN
CHR
USER
TAB
† VAL
† EXT$
† LEN$
† LEFT$
† MID$
† RIGHT$
† SIN
† COS
† TAN
† EXP
† LOG
† SQR

* *Direct mode statements*
† *8K Version only*

MATH OPERATORS

- (unary) Negate
* Multiplication
/ Division
+ Addition
– Subtraction
† ↑ Exponent

RELATIONAL OPERATORS

= Equal
〈 〉 Not Equal
〈 Less Than
〉 Greater Than
〈 = Less Than or Equal
〉= Greater Than or Equal

Your BANKAMERICARD welcome here

WE HONOR master charge THE INTERBANK CARD

© *Copyright 1976 by Southwest Technical Products Corp. 4K and 8K BASIC Version 1.0 program material and manual may be copied for personal use only. No duplication or modification for commercial use of any kind is authorized.*



You guys are out of your minds, but who am I to complain. Send –

☐ 4K BASIC CASSETTE $4.95
☐ 8K BASIC CASSETTE $9.95
☐ MP-68 Computer Kit $395.00

NAME

ADDRESS

CITY STATE ZIP

Southwest Technical Products Corp.
Box 32040, San Antonio, Texas 78284

CIRCLE NO. 1 ON INQUIRY CARD

VOL. 2 NO. 1 DECEMBER 1976



Photo by E-Tronics Technical Corp.
West Los Angeles, California

Cover Story

The holiday season brings together warmth, happiness and a time for sharing with each other. No matter what the preceding year has brought both of good or not so good, all seems to become lost in the excitement, anticipation and friendly cheer that flows at this time. The picture of warmth and happiness depicted on our cover reflects this feeling.

Miss Teresa Cox holds the newest addition to the iCOM family of floppy discs, while the powerful Cromemco ZPU board rests under the tree. Both these products are detailed in feature articles in this issue.

The staff and management of INTERFACE AGE wishes you and yours the happiest of holiday seasons.

Special thanks to Gemco Store, Cerritos, CA for supplying the Christmas tree for our cover and Don Jose's Mexican Restaurant, La Mirada, CA for supplying the warm setting.

DEPARTMENTS

Advertisers Index 128
Cover Story 1
FIFO Flea Market 125
Hardware Report 12
Interfacial 2
Letters to the Editor 8
Micro-Market 127
New Products 58
Update 4

INTERFACE AGE™

MICROCOMPUTING FOR HOME AND SMALL BUSINESS

FEATURES

SUPER CHIP FD1771 — PART III 12
A PHASE-LOCK LOOP CIRCUIT TO SEPARATE THE DATA AND CLOCK — *By ROGER EDELSON*

EXCLUSIVE: iCOM's NEW MICROFLOPPY™ 28
A COMPLETE FLOPPY SYSTEM FOR PERSONAL COMPUTING USE — *By LARRY COURTNEY*

AMI 6800 MICROCOMPUTER CHIP SET 32
A FOUR-PART SERIES ON AMI'S S6800 CHIP SET, PROTOTYPING BOARDS, AND PROGRAM DEVELOPMENT SOFTWARE. — *By ROBERT STEVENS*

THE TECHNICO SUPER STARTER KIT 56
A 16-BIT MICROCOMPUTER UTILIZING THE TI-9900 MPU — *By TERRY DOLLHOFF*

CARD-OF-THE-MONTH 65
THE CROMEMCO ZPU™ CARD — *By ROGER EDELSON*

THE HARDCOPY REVOLUTION 68
A $500 LINE PRINTER OR BUST — *By SIMON HARRISON, Axiom Corp., Pasadena, CA*

SOFTWARE SECTION 73

Edited by ROBERT STEVENS

SOFTWARE BITS & BYTES 78
By R. STEVENS

RELATIVE ADDRESS BACK-STEPPER 80
By J. HUFFMAN

EXHAUSTIVE MEMORY TESTING 82
By T. E. TRAVIS

TEXT EDITOR FOR THE SWTPC-6800 84
By MARK BORGERSON

DR. WANG'S PALO ALTO TINY BASIC 92
By ROGER RAUSKOLB

LLL 8080 BASIC INTERPRETER - PART I 110
By J. BARBER and R. ECKARD

NIBL — NATIONAL'S TINY BASIC 118
By PHIL ROYBAL, National Semiconductor Corp., Santa Clara, CA

INTERFACE AGE Magazine, published monthly by McPheters, Wolfe & Jones, 13913 Artesia Blvd., Cerritos, Calif. 90701. Subscription rates: U.S. $10.00, Canada/Mexico $12.00, all other countries $18.00. Opinions expressed in by-lined articles do not necessarily reflect the opinion of this magazine or the publisher. Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes an endorsement of the product or products by this magazine or the publisher.
INTERFACE AGE Magazine COPYRIGHT © December 1976 by McPheters, Wolfe & Jones. ALL RIGHTS RESERVED. Material in this publication may not be reproduced in any form without permission. Requests for permission should be directed to Nancy Jones, Rights and Permissions, McPheters, Wolfe & Jones, 13913 Artesia Blvd., Cerritos, Calif. 90701.
POSTMASTER: Please send change of address form 3579 and undelivered copies to **INTERFACE AGE** Magazine, 13913 Artesia Blvd., Cerritos, Calif. 90701. Second-class postage paid at Artesia, California 90701 and at additional mailing offices.

INTERFACIAL



A computer for Christmas? Yes, its quite possible, the manufacturers are anticipating an increase in sales this year. Many computer stores now have immediate delivery. Competitive pricing among the manufacturers has caused prices to come down this past year in many areas of the country. Sales and specials are prevalent in many locations. The timing couldn't be more perfect since INTERFACE AGE will present to you several versions of BASIC & Tiny BASIC to get you started. Additional Programs from our Software Depository will further enhance your system. Also in this issue Roger Edelson concludes his report on Western Digitals' FD1771B single chip Floppy Disk Controller/Formatter. Roger covers a typical application of the FD 1771 assuming that the reader has an 8080 based system and a Pertec FD400. Problems of clock data relationships and a phase-lock loop circuit solution are described.

Exclusives generally do not come every day, but iCOM has introduced a new Floppy Disk system, including Interface card, cables, diskette containing iCOMs' FDOS-M Software at a price within the reach of the hobbyist.

Robert Stevens begins a four part series on AMI's S6800 chip set covering the chip set, prototyping boards, and program development.

Now that Texas Instruments' MPU the TI-9900 (a 16 bit microprocessor) has finally reached the hobbyist market Terry Dollhoff describes Technicos' Super Starter™ kit utilizing the TI-9900. Our new products section was overflowing last month (shows that the manufacturers are interested in the hobbyist market), so we will conclude this quarter's edition of New Products with a flurry of late entries destined to make their mark in the industry.

Interested in the Z-80? Cromemcos' new Z-80 ZPU is featured in the Card-of-the Month by Roger Edelson. This is a new series whereby Roger hopes to review and critique the new MPU and peripheral boards that appear in the market place.

A full-formatted line printer for less than $500? Sure, read about the differences starting on page 68. Now, our Software Section is bulging this month. Beginning on page 73, there are eight articles, four of which are major software development program source listings. As mentioned earlier, Tiny BASIC is featured along with a Text Editor program, Micro-BASIC and a memory diagnostic for an 8080 system.

It is extremely pleasing to all of us at INTERFACE AGE to not only wish you and yours a very happy holiday season but to also thank you for your sincere encouragement and support over the past twelve months of Publishing. INTERFACE AGE now enters Vol. 2 with the same objective and goal — to give our readers the best publication on microcomputing money can buy.

If you have any comments or suggestions about articles you would like to see, please let us know by dropping us a note.

Editor

INTERFACE AGE

PUBLISHED BY

McPheters, Wolfe & Jones
13913 Artesia Boulevard
Cerritos, CA 90701
(213) 926-6629

GENERAL MANAGER
NANCY A. JONES

NORTHWESTERN REGIONAL EDITOR
ADAM OSBORNE, PhD

NEW ENGLAND REGIONAL EDITOR
ROBERT E. TRIPP

EDITORIAL CO-ORDINATOR
WILLIAM SEVEDGE

SOFTWARE EDITOR
ROBERT STEVENS

HARDWARE EDITOR
ROGER EDELSON

ASSOCIATE EDITORS
EVA YAKA
JANE HILL ALDEN

PRODUCTION LAYOUT
ROB STUART

ART
CHARLYNE LEVANDOWSKI

SUBSCRIPTION CIRCULATION
JO ANN FERGUSON

NATIONAL SALES MANAGER
BRUCE BERKEY

ADVERTISING—Representative
STEVE RICHARDS
ZACH BOVINETTE

RETAIL CIRCULATION
ZACH BOVINETTE

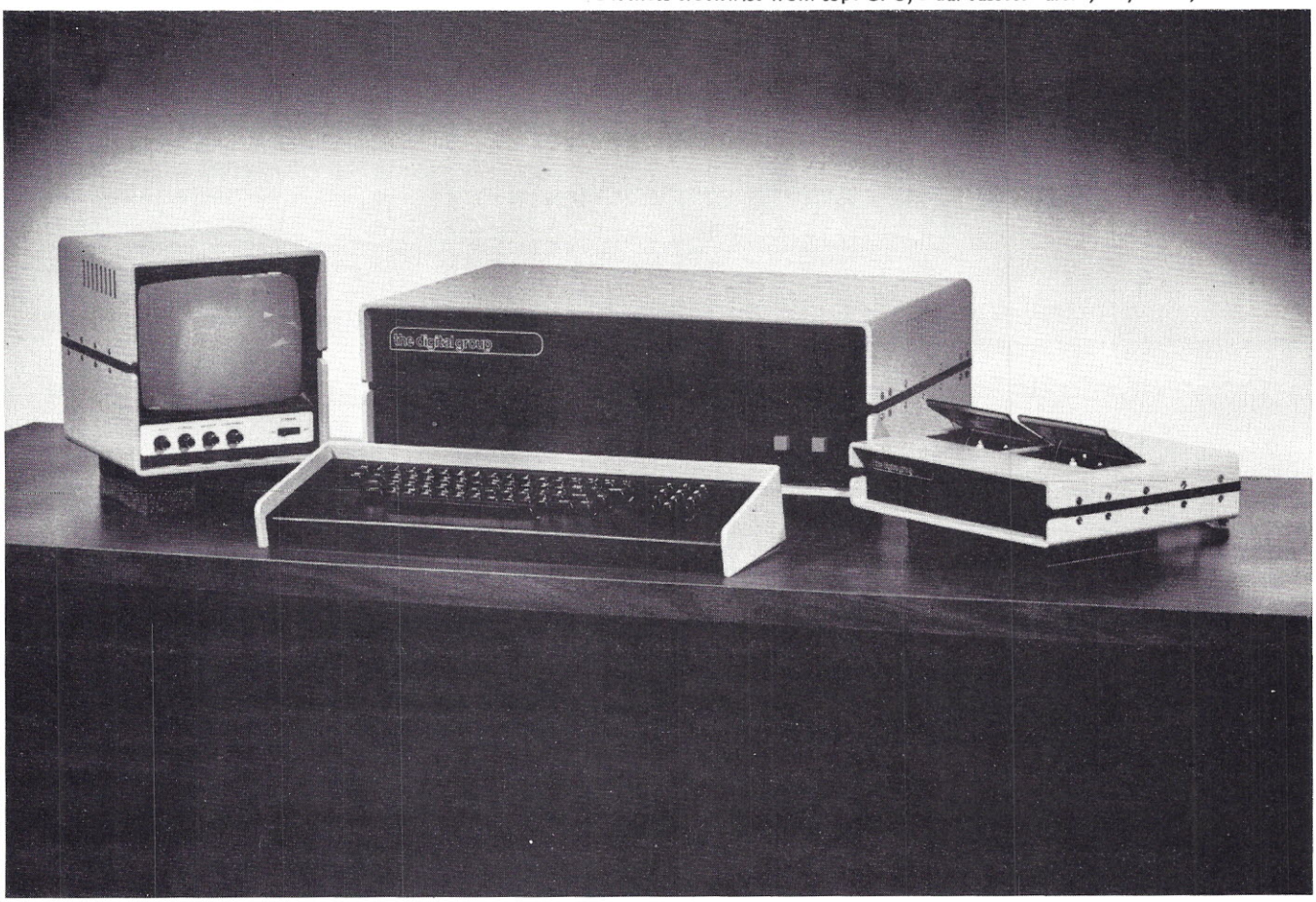
EDITORIAL CORRESPONDENCE

Direct all correspondence to the appropriate editor at: INTERFACE AGE magazine, P.O. Box 1234, Cerritos, CA 90701. Editorial contributions must be accompanied by return postage and will be handled with reasonable care, however, publisher asumes no responsibility for return or safety of manuscripts, art work, or models.

ADVERTISING INQUIRIES

Direct all advertising inquiries to: Advertising Department, INTERFACE AGE magazine, 61 South Lake Avenue, P.O. Box 4566, Pasadena, CA 91106—(213) 795-7002.

Cabinets clockwise from top: CPU, Dual-cassette drive, Keyboard, 9" Monitor.



The Digital Group covers up.

(Beautifully.)

For many months the Digital Group has been hard at work on the heart of our microcomputer system, insisting on quality where it counts in every product we've designed. Now, we have turned our attention to the outside and covered up . . . with a complete line of custom cabinetry that will enhance your Digital Group system for all the world to see. The result is beautiful.

Sleek and sophisticated, but rugged enough to take all the hard knocks you hand out, Digital Group cabinets are made to be used and not just admired. Extra-heavy-duty eighth-inch aluminum is utilized throughout with a special tough-texture commercial-grade paint in Computer Beige. All front panels are anodized aluminum in dark brown. Even the front panel switches are lighted.

The Digital Group offers a beautiful cover-up for each part of your system — from the CPU to the video monitor. What's more, every new Digital Group product will get covered, too, so each piece will maintain that unmistakable Digital Group image.

We're sure you've already fallen madly in love with our cover-ups, but just wait until you take a peek inside. That's where the real beauty lies.

Our video-based systems, including 8080, 6800 and the super new Z-80, are state-of-the-art, high quality and totally integrated designs. Digital Group systems are complete and fully featured and are specifically designed to be easy to use. Merely power on, load cassette and go! (And with our new cover-ups, you go in style.)

Best of all, Digital Group systems are available now. And affordable. Prices for a complete Z-80 based CPU start as low as $645, including the cover-up.

So write or call us for all the beautiful details. And then head for cover!

the digital group

The Digital Group
P.O. Box 6528
Denver, Colorado 80206
(303) 777-7133

CIRCLE INQUIRY NO. 2

UPdate

NOTABLES

The COMPUTER MUSIC JOURNAL will describe the development of computer systems which are capable of producing high fidelity music. Topics to be covered include: production of natural sounding timbre of tone color by Fourier like synthesis, FM synthesis, and other methods; design of real-time playing instruments, real-time output controllers such as keyboards, joysticks, and new designs; circuit design of digital oscillators; very high-speed multiplication; home brew computer music instruments; digital filtering; digital reverberation; review of hardware components; high resolution, high speed digital to analog converters; analysis of acoustic instruments, and reviews of books about computer music, acoustics, psychoacoustics, music theory, computer design, and electronics. The journal will be published non profit by PCC, Box 310, Menlo Park CA 94025. Publication costs will be paid from subscription fees of $14 for one year. The journal will be published every other month starting Dec. 1976. The first issue will be mailed out in January 1977.

CALL FOR PAPERS:

The South Central Kansas Amateur Computer Association has announced that they along with the local Computer stores in Wichita, Kansas are sponsoring the first Mid-America Computer Conference to be held on the Memorial Day Weekend. The two day conference and show is scheduled to be on Saturday and Sunday. Notable speakers are being invited to speak at this event. If you wish further information please contact Mr. Cris Borger, President of the So. Central Kansas Amateur Computer Assoc., 1504 N. St. Clair, Wichita, Kansas 67200.

COMPUTER GRAPHICS CONFERENCE

The Fourth Annual Conference on Computer Graphics and Interactive Techniques, July 20-22, 1977, in San Jose CA is sponsored by the Association for Computing Machinery's Special Interest Group for computer graphics, will focus on computer graphics and interactive techniques. Papers are solicited on graphical theory, techniques, applications and education. A short abstract is requested by Dec. 31, and should be sent to James E. George, Los Alamos Scientific Laboratory, P.O. Box 1663, MS 272, Los Alamos, New Mexico, 87545.

COMPUTER HOBBYIST CONVENTIONS

Dec. 16, 1976 Western Microcomputer Show, Sheraton Hotel, Anaheim, CA.

April 15-17, 1977 The First West Coast Computer Faire, Civic Auditorium, San Francisco, CA. 50 sessions, 200 exhibitors.

May 28-29, 1977 Mid-America Computer Conference, Wichita, KS.

June 1977 Midwest Regional Computer Conference, Cleveland, OH.

June 1977 Midwest Regional Computer Conference, Dallas, TX. 100 sessions, 250 exhibitors.

June 18-19, 1977 Atlanta Computerfest, Atlanta, GA.

June 29-30, 1977 Seattle Computerfest, Seattle, WA.

Aug. 27-28, 1977 Personal Computing '77, Consumer Trade Show, Atlantic City, New Jersey.

SDCS NOW TAX EXEMPT EDUCATIONAL ORGANIZATION

The San Diego Computer Society announced that based on their current activities the SDCS is tentatively classified as a tax exempt, publicly supported educational organization until December 31, 1977. This means that in addition to SDCS not having to pay taxes (non-profit organization) donors may deduct contributions to SDCS as provided in section 170 of the IRS code.

TRENTON COMPUTER FESTIVAL

The Amateur Group of New Jersey along with the IEEE, the Trenton State College Computer Club, Philadelphia Area Computer Society, and the Trenton State College Engineering Technology Dept. will be sponsoring the Trenton Computer Festival to be held April 30 to May 1, 1977 at Trenton State College. Allen Katz, the co-ordinator for the festival is expecting more than 3000 visitors and 85 exhibitors. There will be hardware exhibits along with technical sessions and an outdoor flea market. Volunteers are still needed to help with the show. If you are interested: contact Mr. Katz at 609-443-3184.

CALENDAR

Dec. 15 Denver Amateur Computer Society DACS, 7:30 p.m. at 4101 E. Hampden Av., Denver, CO. For more information call: (303) 333-1047.

Dec. 15 Northwest Computer Club, meets at 7:00 p.m., Pacific Science Center, Seattle, WA. Informal Meeting. For more information call: (206) 524-6359.

Dec. 15 Texas A&M microcomputer Club, 7:30 p.m., Room 333B, Zachry Engineering Center. For more information call: (713) 823-0877 or (713) 693-1161.

Dec. 16 South Florida Computer Group, Ft. Lauderdale Division, 7:30 p.m., FPL, 501 S. Andrews, Ft. Lauderdale, FL. For more information call: (305) 522-5358.

Dec. 17 Amateur Computer Group of New Jersey, 7:00 p.m., Middlesex County College, Edison, NJ. For more information call: (201) 277-2063.

Dec. 18 South Central Kansas Amateur Computer Association meets at 9:00 a.m., 1430 E. Kellog (next to Church of the Nazarene) meeting on interfacing the 8080 based system to peripherals. For more information contact Cris Borger (316) 945-9658.

Dec. 18 Southern California Computer Society, Los Angeles Chapter. Call Representatives for time and agenda.

Dec. 19 Chicago Area Computer Hobbyist Exchange (CACHE) meets at 12:00 noon at NIGAS Bldg., Schermer Rd., Glenview, IL. Family Christmas Meet. Games and family participation Call Bill Precht at (312) 620-1671 or P.O. Box 36, Vernon Hills, IL 60061.

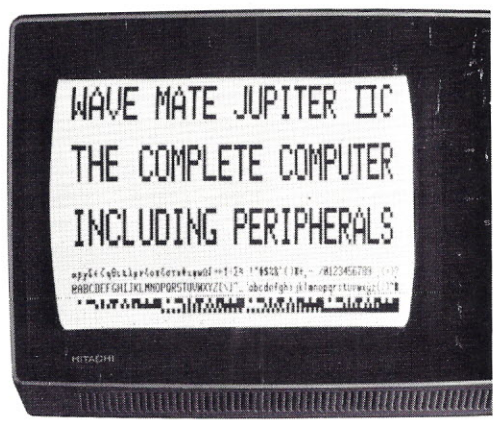
Dec. 19 Cleveland Digital Group meets at 2:00 p.m., 8700 Harvard Av., Cleveland, Ohio.

Dec. 21 El Paso Computer Group meets at 7:00 p.m. Meeting place information call (915) 544-1542.

Dec. 22 Homebrew Computer Club meets at 7:00 p.m., Stanford Linear Accelerator Center Auditorium, Menlo Park, CA. Call (415) 967-6754 for further details.

Now we're on TV!

Wave Mate introduces Jupiter IIC, a complete computer system incorporating a monitor quality TV interface. This system provides everything you need to create and run application programs. Jupiter IIC includes a CPU with 8K dynamic RAM and 3K ROM memory, video terminal interface and keyboard, and dual audio cassette tape interface. The TV interface features upper and lower case and Greek character sets, and dot graphics. The dual audio cassette interface provides start/stop operation and operates at 300, 600, or 1200 baud. And of course we still provide these high-quality features: burn-in tested IC's, socketed IC's, complete documentation, and more.



ATTENTION: ORIGINAL EQUIPMENT MANUFACTURERS

Jupiter IIC provides OEMs with the tools to get systems into the field faster and at lower cost. (1) Use Jupiter IIC as your development system. Perfect for development of software and special hardware. (2) Use Jupiter IIC for prototype systems. Only Wave Mate provides the tools – wire wrap modules, universal modules, complete documentation – to easily tailor system logic and add customized interfaces within the basic Jupiter IIC package.

SOFTWARE

All Jupiter IIC systems feature a sophisticated monitor/debugger package including a versatile interrupt system and I/O monitor call instructions. A programmable macro editor and expanded assembler are also provided. Proposed ANSI standard BASIC is included with Jupiter IIC.

THE JUPITER IIC KIT: $2850

The kit includes the CPU, software debugger and monitor module, 8K dynamic memory, module cage, power supply, front panel, video interface, cassette interface, and all the documentation required to assemble, run, and understand the system as well as modification instructions for a black and white TV set.

THE JUPITER IIC ASSEMBLED SYSTEM: $3800

All components of the Jupiter IIC kit plus two audio cassette units and a 12-inch black and white TV set. The complete system is shipped with all components assembled and tested.

SPECIFICATIONS

CPU

MC 6800; eight-level interrupt, prioritized and maskable by level; single-cycle and block DMA

DUAL AUDIO CASSETTE

Complete paper tape replacement; start/stop motor control; 300, 600, or 1200 baud (crystal controlled); error correction

VIDEO TERMINAL INTERFACE

64 x 32 lines; Upper and lower case, plus Greek alphabet; 7 x 12 format, 128 dot (hor.) x 96 dot (vert.) graphics

MEMORY

8K dynamic RAM; 3K ROM; 1K dual-port static RAM

KEYBOARD

Generates full 128-character ASCII set



☐ Send details on Jupiter II systems
☐ Have salesman call

Name _____
Title _____
Company _____
Address _____
City _____ State _____ Zip _____
Phone _____

Wave Mate

WAVE MATE 1015 West 190th Street, Gardena, California 90248 Telephone (213) 329-8941
Dept. 201

CIRCLE INQUIRY NO. 3

Jan. 3 South Florida Computer Group, Miami Division meets at 7:30 p.m., PAP Institute, 1155 NW 14th St., Miami, FL. General Meeting. For more information call (305) 271-2805.

Jan. 4 El Paso Computer Group meets at 7:00 p.m.. Meeting place information call (915) 544-1542.

Jan. 5 Northwest Computer Club meets at 7:00 p.m., Pacific Science Center, Seattle, WA. Informal Meeting. Details by calling (206) 524-6359.

Jan. 5 New England Computer Society, Inc. meets at 7:00 p.m., MITRE Corp. cafeteria, Route 62, Bedford, MA. For further information call Dave Day (603) 434-4239.

Jan. 5 Southern California Computer Society Valley Chapter meets at 7:00 p.m., Harvard School, 3700 Cold Water Canyon, Studio City, CA. Technical session on the TI-9900 Microprocessor by a representative of Texas Instruments Co. Call John Scott at (213) 849-4094 for further details.

Jan. 8 The Permian Basin Computer Group, Midland Chapter meets at 4:00 p.m., Midland College, Occupational Technology Bldg., Room 110. More details call (915) 697-4607.

Jan. 8 The Permian Basin Computer Group, Odessa Chapter meets at 1:00 p.m., Odessa College, Electronics Technology Bldg., room 203. Please call (915) 332-9151 for further details.

Jan. 8 Louisville Area Computer Club meets at 1:00 p.m., Speed Auditorium, University of Louisville. General meeting. Contact Glen Darwin (502) 456-5589 or by writing at 3028 Hunsinger Ln., Louisville, KY 40200.

Jan. 9 Southern California Computer Society, Orange County Chapter meets at 12:00 noon, California State University, Fullerton, Administration Bldg., Room 321. For meeting agenda call: Lorin Mohler at (714) 998-5831.

Jan. 9 University of Chicago Computer Club meets at 1:00 p.m., Reynolds Club, 57th and University, Chicago, IL. For more information call (312) 421-0244.

Jan. 9 Oklahoma Computer Club meets at 10:00 a.m., Bell Aisle Library, Oklahoma City, OK. General Meeting. Call Al Campbell (405) 842-4933.

Jan. 13 Rochester Area Microcomputer Society meets at 6:30 p.m., Room 1030, Bldg. 9, Rochester Institute of Technology, Rochester, NY. Meeting will feature William Mathis and the inside scoop on the KIM-1. Mailing address, RAMS, P.O. Box D, Rochester, NY 14609.

Jan. 14 Cresent City Computer Club meets at 8:00 p.m., University of New Orleans, Lakefront Campus. Contact Bob Latham (504) 722-6321 or P.O. Box 1097, New Orleans, LA 70122.

Jan. 15 South Central Kansas Amateur Computer Association meets at 9:00 a.m., 1430 E. Kellog (next to Church of the Nazarene). Call Cris Borger at (316) 945-9658 for more information.

Jan. 19 Denver Amateur Computer Society DACS meets at 7:30 p.m., 4101 E. Hampden Av. Denver, CO. General Meeting. Call (303) 333-1047.

Jan. 19 Northwest Computer Club meets ar 7:00 p.m., Pacific Science Center, Seattle, WA. General Meeting. Details of agenda: call (206) 524-6359.

Jan. 20 South Florida Computer Group, Ft. Lauderdale Division meets at 7:30 p.m., FPL, 501 S. Andrews, Ft. Lauderdale, FL. Call (305) 522-5358 for more details.

Jan. 22 Minnesota Computer Society, 7:30 p.m., Hennepin County Library, Southdale Branch, 7001 York Ave South, Edina, MN. For meeting agenda write, MCS, P.O. Box 35317, Minneapolis, MN 55435.

Jan. 30 Chicago Area Computer Hobbyists Exchange (CACHE) meets at 12:00 noon, NIGAS Bldg., Shermer Rd., Glenview IL. LSI-11 Conference, Digital Equipment Corporation Show. Call Bill Precht at (312) 620-1671 or P.O. Box 36, Vernon Hills, IL 60061.

Feb. 1 El Paso Computer Group meets ar 7:00 p.m. Meeting place by calling (915) 544-1542.

Feb. 2 New England Computer Society, Inc. meets at 7:00 p.m., MITRE Corp., Cafeteria, Route 62, Bedford MA. Call Dave Day for more information at (603) 434-4239.

Feb. 5 Louisville Area Computer Club meets at 1:00 p.m., Speed Auditorium, University of Louisville. General meeting. Contact Glen Darwin (502) 456-5589 or by writing at 3028 Hunsinger Ln., Louisville, KY 40200.

Feb. 11 Crescent City Computer Club meets at 8:00 p.m., University of New Orleans, Lakefront Campus. For more information contact Bob Latham (504) 722-6321.

Feb. 11 Rochester Area Microcomputer Society, 6:30 p.m., Room 1030, Bldg. 9, Rochester Institute of Technology, Rochester, NY. Mailing address, RAMS, P.O. Box D, Rochester, NY 14609.

Feb. 12 The Permian Basin Computer Group, Midland Chapter meets at 4:00 p.m., Midland College, Occupational Technology Bldg., Room 110. General Meeting. Call (915) 697-4607 for details.

Feb. 12 The Permian Basin Computer Group, Odessa Chapter meets at 1:00 p.m., Odessa College Electronics Technology Bldg., Room 203. Call (915) 332-9151 for more information.

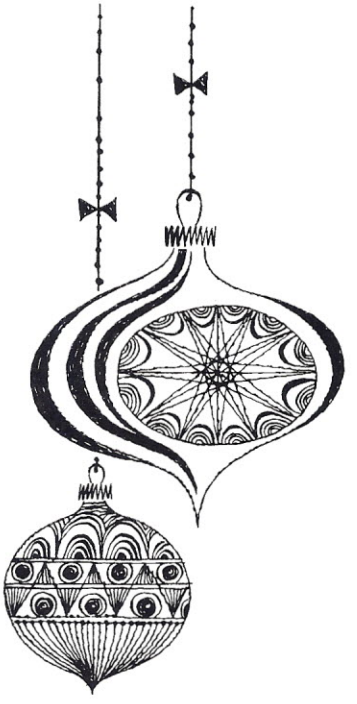
Feb. 27 Chicago Area Computer Hobbyists Exchange (CACHE) meets at 12:00 noon, NIGAS Bldg., Schermer Rd., Glenview IL. Sick Computer Show. Bring in your problems and we'll help repair them. Call Bill Precht at (312) 620-1671.

Mar. 2 New England Computer Society, Inc., meets at 7:00 p.m., MITRE Corp., Cafeteria, Route 62, Bedford, MA. General Meeting. Call Dave Day at (603) 434-4239.

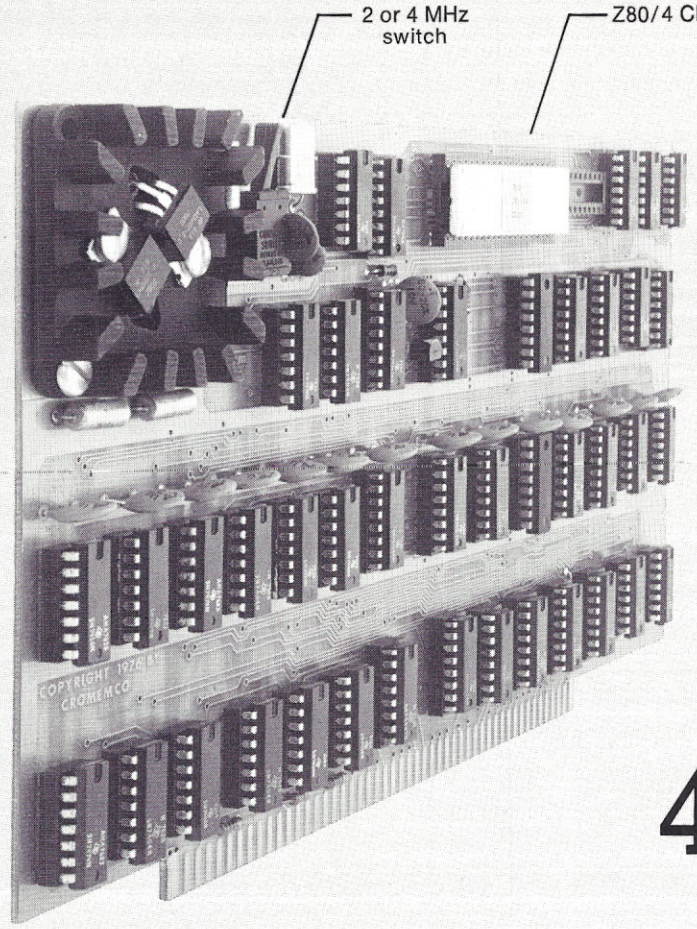
Mar. 10 Rochester Area Microcomputer Society, 6:30, Room 1030, Bldg. 9, Rochester Institute of Technology, Rochester, NY. Mailing address, RAMS, P.O. Box D, Rochester, NY 14609

Mar. 27 Chicago Area Computer Hobbyists Exchange (CACHE) meets at 12:00 noon, NIGAS Bldg., Schermer Rd., Glenview, IL. Small Business Opportunities Show. For further information contact Bill Precht (312) 620-1671.

Seasons



Greetings



The only CPU card to give you 4 MHz speed

2 - 5X MORE THROUGHPUT

Here is by far the most powerful CPU card now available.

It's Cromemco's new ZPU™ card.

It uses the slick new Z-80 chip — in fact, it uses the even faster Z80/4 high speed version of the Z-80 — and it's the *only* card that does. The Z80/4 is **certified** by its manufacturer for 4 MHz operation.

The Z80/4 has all the advantages of the 8080 and 6800 — and enormously more.

And Cromemco's new ZPU **does** enormously more.

4 MHz CLOCK RATE

First, the ZPU lets you choose either a 2 or 4 MHz crystal-controlled clock rate. Right away that means you can have twice the throughput. Cuts program running time in half. Then the instruction set of the Z80/4 reduces software even more.

The 2 or 4 MHz clock rate is switch-selectable as shown in the above photo.

POWER-ON MEMORY JUMPS

Cromemco's ZPU also has some neat design innovations of its own.

For example, you'll like the simplified operation you get because upon power turn-on the ZPU will jump to any desired 4K boundary in memory. No switch flipping to go through to begin your program.

SELECTABLE WAIT STATES

Cromemco engineers have also arranged that your present systems will always be useful with the new ZPU. To do this, the ZPU has been designed to have jumper-wire-selectable wait states on the card.

These simplify interfacing with your present memory or I/O even at 4 MHz operation.

80 ADDITIONAL INSTRUCTIONS

You've probably heard that the Z-80 with its 80 new additional instructions is by far the most powerful chip around. It's true.

That means with the ZPU you will be able to devise much more powerful (as well as faster) software than before.

ALTAIR/IMSAI COMPATIBLE WITHOUT MODIFICATION

Yes, the new ZPU is plug-compatible with the Altair 8800 and IMSAI 8080. Just remove the existing CPU, plug in the ZPU card, and you're up and running.

Further, the Cromemco ZPU is the only card guaranteed to work with all present and future Cromemco peripherals. (Cromemco manufactures the popular BYTESAVER™ memory, the TV DAZZLER™, the D+7A™ analog interface board, a joystick console, and others.

INCLUDES FREE SOFTWARE

The ZPU comes with our powerful Z-80 monitor, complete documentation, source code, and paper tape object code. The monitor is also available in PROM ($75) for use in our BYTESAVER memory board.

STORE/MAIL

The new ZPU is available as a kit or assembled. Look into it now because you can see demand will be strong. Present delivery is 30 days.

ZPU kit (Model ZPU-K) $295

ZPU assembled (Model ZPU-W) $395

California users add 6% sales tax.

Cromemco

Specialists in computer peripherals

2432 Charleston Rd., Mountain View, CA 94043 • (415) 964-7400

CIRCLE INQUIRY NO. 4

Letters to the Editor

Dear Editor:

I have an IMSAI 8080 system using the PolyMorphic video board and I am having a hard time finding any programs that I can use. All the programs I have seen in this magazine and others use TTY port (serial) output and I can't use them. Do you know of any programs written for this video board system? If so please let me know. Thank you.

David Austin
31 Julian Ave.
Napa, CA 94558

Maybe some of our readers will be able to assist as well. Look for a full spectrum of programming in future issues — especially the February issue.

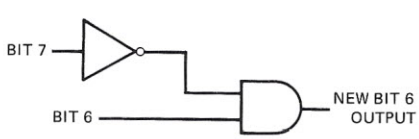
Editor

Dear Editor:

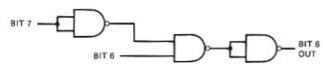
I don't know if anyone has published anything like the following in your magazine, but:

I recently finished my TV typewriter II and got hold of a semi-professional keyboard containing the General Instruments AY-5-2376 keyboard encoder.

As the typewriter uses a 2513 character generator, upper case only, and the encoder produces upper and lower case characters — I found it necessary to make the encoder upper case only. I discovered a quite simple circuit to do this.



This circuit can be modified more to enable/disable it to work by using a 3-Input gate instead of the 2-Input. I was able to make the former circuit with one 2-Input hand device.



Hope someone might need this.

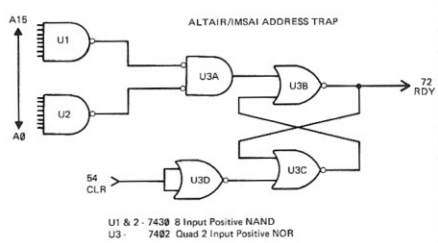
Thomas Mynar
California Polytechnic University, Pomona
Computer Center
3801 West Temple
Pomona, CA 91768

Dear Editor:

I am a new subscriber and have received your September issue — my first. I enjoyed the magazine and have written for back issues. However, I did notice a couple of errors in the magazine.

Firstly, Figure 1 in Scott Wilcox's Hardware Report on page 80 contains two errors. The outputs of the 7430S should not be tied together as shown, and the 740Z should be shown either as a Negative NAND or as a Positive NOR device, not as a Positive NAND. I've redrawn the figure and am enclosing a copy of my version.

Secondly, a much more minor error in MAL Lockwood's article on Micro-Business. The two text blocks on page 29 are reversed. The block on the left should be on the right, and vice versa.



U1 & 2 - 7430 8 Input Positive NAND
U3 - 7402 Quad 2 Input Positive NOR

Aside from these two errors which I noticed, I did enjoy the magazine very much. The selection and the presentation of material make it both readable and informative, a rare combination. I'm looking forward both to the back issues I've ordered and to future issues.

William T. Mitchell
Hanover Park, IL 60103

The Intecolor® 8001 Christmas Kit Is Now Available Through The Following Authorized Distributors

CALIFORNIA

Byte Shop
155 Blossom Hill Rd.
San Jose, Ca. 95123
(408) 226-8383

Computer Store
1093 Mission St.
San Francisco, Ca. 94103
Al Goodwin
(415) 431-0640

The Computer Center
8205 Ronson Rd.
San Diego, Ca. 92111
John Perry
(714) 292-5302

The Computer Mart of Los Angeles
625 W. Katella No. 10
Orange, Ca. 92667
(714) 633-1222

GEORGIA

The Computer Systems Center
3330 Piedmont Rd., NE
Atlanta, Ga. 30305
(404) 231-1691

ILLINOIS

Itty Bitty Machine
1316 Chicago Ave.
Evanston, Ill. 60201
(312) 328-6800

INDIANA

Home Computer Shop
10447 Chris Dr.
Indianapolis, Ind. 46229
James B. Baughn
(317) 894-3319

MASSACHUSETTS

The Computer Store
120 Cambridge St.
Burlington, Mass. 01803
(617) 272-8770

WASHINGTON

Retail Computer Store
410 N.E. 72nd Street
Seattle, Wash. 98115
(206) 524-4101

Or Contact Us Direct

5965 Peachtree Corners East
Norcross, Georgia 30071
Telephone (404) 449-5961

CIRCLE INQUIRY NO. 5

The Intecolor® 8001 Christmas Kit.

It's an intelligent terminal for $1395.* Or your personal computer for an additional $1295.



THE CHOICE IS YOURS.

For only $1395 you can now order the complete **Intecolor** 8001 8-Color, Intelligent CRT Terminal Kit that's colorful, and easy to operate. You can also invest another $1295 to convert the **Intecolor** 8001 Terminal into your very own personal computer. Here's what it's all about.

THE $1395 CHRISTMAS KIT

When we said complete we meant complete. The 8001 Christmas kit includes the 8080 CPU, an 8-Color CRT Terminal, 4K RAM Refresh, Keyboard, Selectable Baud Rate up to 9600, RS 232 I/O, and an Instruction Manual which explains every assembly step. All in a single package. It's a complete stand-alone system which features our unique **Intecolor** 8001 NINE SECTOR CONVERGENCE SYSTEM for minimum set-up time and exceptional stability. Three to five minutes is all it takes for outstanding color registration.

THE $1295 PERSONAL COMPUTER ADDITION

Here's what you get to convert your **Intecolor** 8001 Terminal into your own personal computer. BASIC, Additional 8K RAM Work Space, Insert/Delete, Background Color, Lower Case ASCII Characters, Roll, 48 Line X 80 Characters/Line, 2X Character Height, and a Graphics Mode with 160X192 Elements. The applications are unlimited. Graphics and computations, check book balancing, education instruction and tutoring and a unique variety of computer games. You'll have your own personal micro computer at your fingertips. For the most simple and complex tasks.

CIRCLE INQUIRY NO. 6

WRITE OR CALL US TODAY

We know you're going to have some questions and we've got the answers. So contact your nearest **Intecolor** 8001 distributor or give us a call. We think we've come up with a great system with a price that can't be beat. Make us prove it to you.

Intelligent Systems Corp.®
5965 Peachtree Corners East
Norcross, Georgia 30071
Telephone (404) 449-5961

*Domestic USA Price

Dear Editor:

Now that INTERFACE AGE has split with SCCS, I think its time for me to register a few opinions on editorial content (I have no objections to your advertising policy — those ads keep my subscription rates reasonable . . . have you ever checked the price of a no-advertisements professional journal — Outta-sight!). There are about a half-dozen magazines out now or coming out soon with the computer hobbyist as their main target. No one of these magazines can be all things to all personal computer users. We are just too diverse in our interests and objectives. I would hate to see more than one of these magazines end up trying to be the *Popular Mechanics* of the microcomputer field. On the other hand, I would hate to see *Interface Age* try to become a hardware-oriented magazine like *Byte*. I think it is up to you and the other editors to chart a course for your magazine, a course that will make your product the best in its field. In my opinion, an excellent goal would be to aim at the intermediate level personal computer user. That is, a person with working hardware and about 3-5 months experience with that hardware. Since I have specified a user with an operating microcomputer system the next point follows naturally — Slant your editorial content about 60-40 toward software. What I, and many other active hobbyists need, is more software to increase the capabilities of my existing hardware. I don't want you to eliminate hardware articles completely, but keep them at a reasonable level of complexity. Reports on the available kits for peri-pheral devices and explicit interfacing instructions are good areas to explore more fully.

Now that I have told you what to put into your magazine, I guess its time to tell your publisher how to print the magazine. If you find this paragraph somewhat more difficult to read than the last, you will understand my objections to software articles where the program listings are printed half size. If I am trying to copy some machine language code, or even a BASIC program into my computer from your magazine, it is very important that I be able to distinguish 8s from Bs. Full size copy makes this very much simpler. For example, in the August issue, you ran Basic programs in three different type sizes. The largest (page 50) was very legible, and copying errors could only be ascribed to personal carelessness. The intermediate size (page 75) is still acceptable and legible at a standard 14" eye-to-page distance (standard for me anyway). The smallest type size (page 64) is abominable! If you get your eyes more than 8" from the page, it becomes nearly invisible! I don't know about you, but I simply can't comfortably read that program and enter it into my computer at the same time. The number of lines per vertical inch turned out to be 6, 9 and 12 for the three type sizes. Since I know paper costs money, I will accept a compromise value of 8 lines per inch (standard teletype is 6 lines per inch, roughly). But please, no more 12 per inch microtype!!

Mark Borgerson
Corvallis, OR

Dear Editor:

Enclosed is a software applications article that I have written which I hope you may be able to use in your magazine. I am very impressed by the increasing quality of your magazine since it departed from the SCCS fold and I hope to contribute more short software articles. If you find that you are unable to use the article, please return it to me in the enclosed envelope. Thank you for your time.

Michael P. Burton

Dear Editor:

I have had this issue (September) for two days. This is the first copy I have seen. I've read it cover to cover. Great!

Gary Fisk
Lake Charles, LA

Introducing an 8k RAM Board that gives you a lot more versatility– for a lot less money!

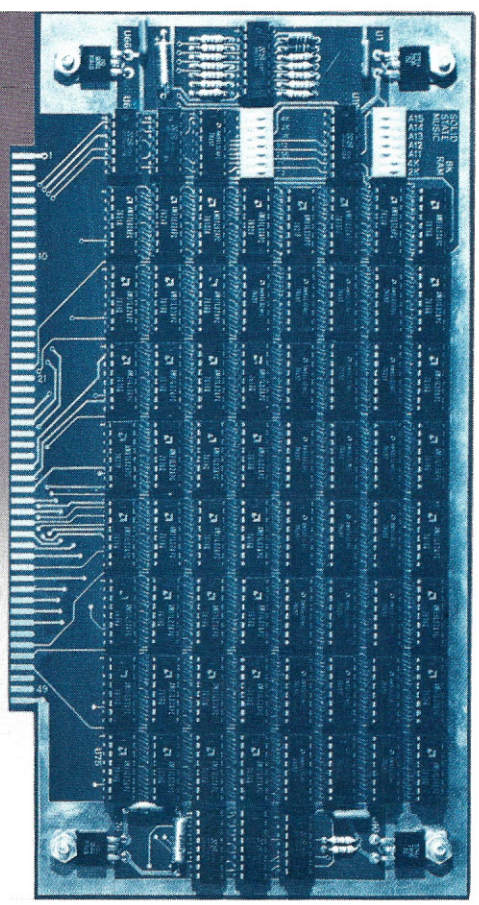
The new MB6A Blue Board is compatible with Altair 8800 or IMSAI 8080 systems.

Look at these features:

- Low power—500 NS access—no wait cycle.
- DIP switch selection of memory protect increments (256, 512, 1k, 2k, 4k, or 8k).
- Provision for battery back up.
- Plus TI low profile sockets, gold-plated edge connectors, solder masked, first line parts and **guaranteed for 90 days.**

$250.00 in easy-to-assemble kit form includes complete documentation and assembly instructions. $295.00 assembled.

The MB6A is available off-the-shelf through your computer hobbyist stores or direct, along with our other fine products including processor, memory, I/O, mother and extender boards.



cybercom — A Division of Solid State Music

We're the blue boards.

2102A Walsh Avenue
Santa Clara, CA 95050 Telephone (408) 246-2707

CIRCLE INQUIRY NO. 31

Apple Introduces the First Low Cost Microcomputer System with a Video Terminal and 8K Bytes of RAM on a Single PC Card.

The Apple Computer. A truly complete microcomputer system on a single PC board. Based on the MOS Technology 6502 microprocessor, the Apple also has a built-in video terminal and sockets for 8K bytes of on-board RAM memory. With the addition of a keyboard and video monitor, you'll have an extremely powerful computer system that can be used for anything from developing programs to playing games or running BASIC.

Combining the computer, video terminal and dynamic memory on a single board has resulted in a large reduction in chip count, which means more reliability and lowered cost. Since the Apple comes fully assembled, tested & burned-in and has a complete power supply on-board, initial set-up is essentially "hassle free" and you can be running within minutes. At $666.66 (including 4K bytes RAM!) it opens many new possibilities for users and systems manufacturers.

You Don't Need an Expensive Teletype.

Using the built-in video terminal and keyboard interface, you avoid all the expense, noise and maintenance associated with a teletype. And the Apple video terminal is six times faster than a teletype, which means more throughput and less waiting. The Apple connects directly to a video monitor (or home TV with an inexpensive RF modulator) and displays 960 easy to read characters in 24 rows of 40 characters per line with automatic scrolling. The video display section contains its own 1K bytes of memory, so all the RAM memory is available for user programs. And the Keyboard Interface lets you use almost any ASCII-encoded keyboard.

The Apple Computer makes it possible for many people with limited budgets to step up to a video terminal as an I/O device for their computer.

No More Switches, No More Lights.

Compared to switches and LED's, a video terminal can display vast amounts of information simultaneously. The Apple video terminal can display the contents of 192 memory locations at once on the screen. And the firmware in PROMS enables you to enter, display and debug programs (all in hex) from the keyboard, rendering a front panel unnecessary. The firmware also allows your programs to print characters on the display, and since you'll be looking at letters and numbers instead of just LED's, the door is open to all kinds of alphanumeric software (i.e., Games and BASIC).

8K Bytes RAM in 16 Chips!

The Apple Computer uses the new 16-pin 4K dynamic memory chips. They are faster and take ¼ the space and power of even the low power 2102's (the memory chip that everyone else uses). That means 8K bytes in sixteen chips. It also means no more 28 amp power supplies.

The system is fully expandable to 65K via an edge connector which carries both the address and data busses, power supplies and all timing signals. All dynamic memory refreshing for both on and off-board memory is done automatically. Also, the Apple Computer can be upgraded to use the 16K chips when they become available. That's 32K bytes on-board RAM in 16 IC's—the equivalent of 256 2102's!

A Little Cassette Board That Works!

Unlike many other cassette boards on the marketplace, ours works every time. It plugs directly into the upright connector on the main board and stands only 2" tall. And since it is very fast (1500 bits per second), you can read or write 4K bytes in about 20 seconds. All timing is done in software, which results in crystal-controlled accuracy and uniformity from unit to unit.

Unlike some other cassette interfaces which require an expensive tape recorder, the Apple Cassette Interface works reliably with almost any audio-grade cassette recorder.

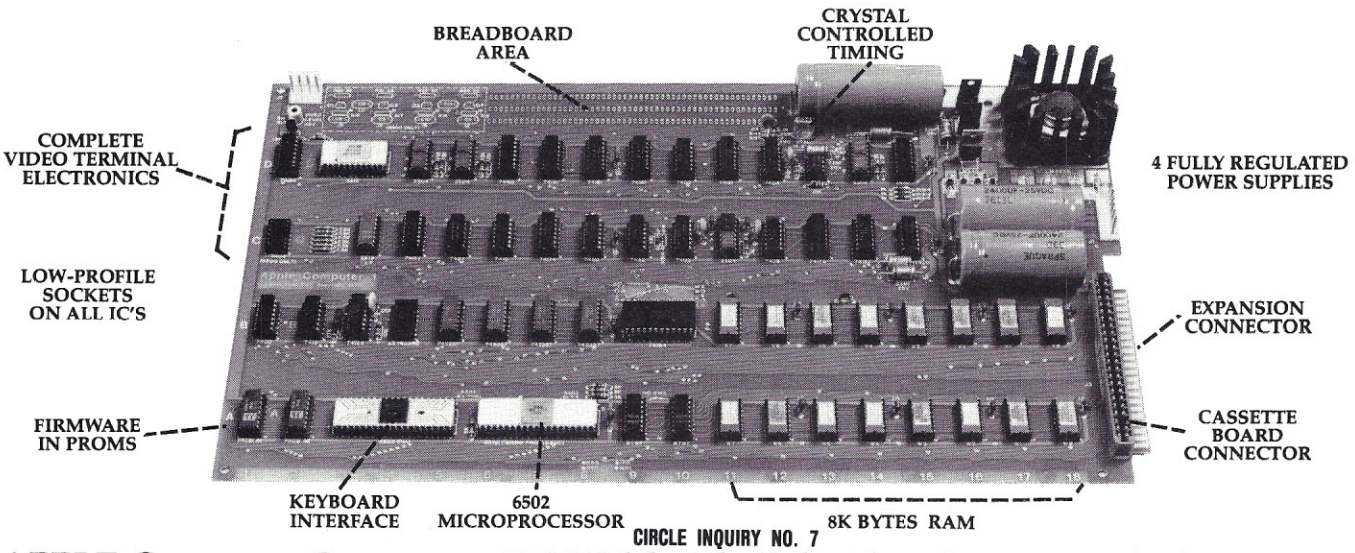
Software:

A tape of **APPLE BASIC** is included free with the Cassette Interface. Apple Basic features immediate error messages and fast execution, and lets you program in a higher level language immediately and without added cost. Also available **now** are a dis-assembler and many games, with many software packages, (including a macro assembler) in the works. And since our philosophy is to provide software for our machines free or at minimal cost, you won't be continually paying for access to this growing software library.

The Apple Computer is in stock at almost all major computer stores. (If your local computer store doesn't carry our products, encourage them or write us direct). **Dealer inquiries invited.**

Byte into an Apple $666.66*

* includes 4K bytes RAM



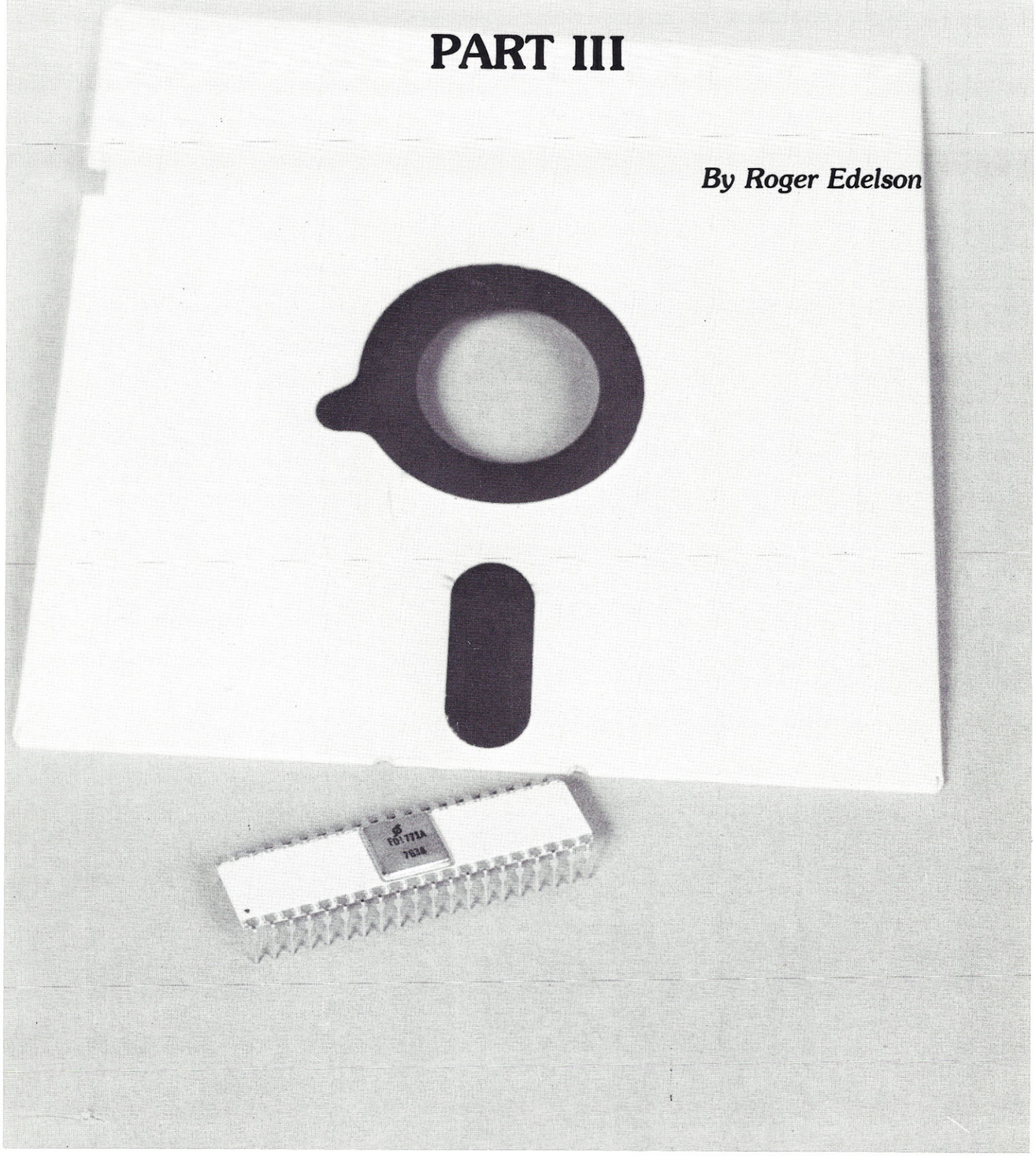
CIRCLE INQUIRY NO. 7

APPLE Computer Company • 770 Welch Rd., Palo Alto, CA 94304 • (415) 326-4248

Super Chip FD1771

PART III

By Roger Edelson



Last month we completed our review of Western Digital's FD1771 Floppy Disk Formatter/Controller, now lets see how the chip is used in a typical application. In this case we will assume an 8080 type microprocessor as the computer, and a Pertec FD400 Floppy Disk. Since in many cases the disk drive will not supply a stable clock data relationship, we will describe a phase-lock loop circuit which will separate the data and clock.

FD1771 - Processor Interface

All commands, status and data are transferred over the 3 state bidirectional $\overline{DAL}$ (Data Access) lines. These 8 lines present an open circuit to the common processor peripheral bus until activated by the $\overline{CS}$ (Chip Select) signal. An active $\overline{CS}$ combined with $\overline{RE}$ (Read Enable) sets the $\overline{DAL}$ into the transmitter mode while the $\overline{CS}$ combined with active $\overline{WE}$ (Write Enable) sets the $\overline{DAL}$ in the receiver mode. The information in the FD1771 resides in 5 accessible 8 bit registers. These registers are: (1) The bidirectional Data Register active as a parallel buffer for read or write operations, (2) The command register which receives and stores commands from the processor, (3) the sector register which receives the desired sector number to be accessed, (4) the track register which contains the present Track position or receives the desired track number to be accessed, (5) The Status Register containing information about the present operation.

The accessing of the registers is accomplished by a combination of active levels on the $\overline{CS}$, $\overline{RE}$ or $\overline{WE}$, and the register address lines A1 and A0. The Command Register can only receive information and the Status Register can only transmit information.

Two signals are available to aid in program response to the FD1771. The INTRQ (Interrupt Request) is activated by the controller whenever an operation is completed successfully or terminated by a fault. The DRQ (Data Request) signal is available as an indication of the chips readiness to transfer a byte of data during read or write operations.

A 2MHz clock is required by the chip as a reference for all timed signals such as motor controls. The $\overline{MR}$ (Master Reset) clears the command register and initiates a Restore (seek track 00) Command when the $\overline{MR}$ line is returned to an inactive state.

Figure 1 shows a possible processor FD1771 interface. As we will be using a phase-lock-loop to separate data and clock the $\overline{XTDS}$ line (pin 25) is grounded. If disk initialization is not contemplated then the $\overline{DINT}$ line should be grounded. In this case whenever a Write Track command is received, the FD1771 will sample the $\overline{DINT}$ input. If $\overline{DINT}$ = 0, the command will be terminated, an interrupt is generated and the Write Protect Status bit will be set. If your usage might require initialization of the disk then a switch can be provided here.

Since the Pertec FD400 requires a step-in on a step-out command then the three-phase control line ($\overline{3PM}$) must be set at +5V. The PTT1 output will now become a STEP output and the PHz signal will become the DIRECTION OUTPUT - active high when stepping in. Later we will cover the circuitry for getting STEP-IN and STEP-OUT from STEP and DIRECTION.

The $\overline{DAL}$, Data Access Lines, being bidirectional should be connected to both an input and output port. The $\overline{DAL}$ lines are inverted and also used to transfer status and control in/out of the FD1771.

A DM8136 (a b-bit bus comparator) is used for address selection of the FD1771. Address lines A2 - A7 are applied to the high-impedance bus receivers (a maximum of 50 μa). The respective TTL inputs are either grounded or connected to +5V, depending on the address to be used. The $\overline{STROBE}$ input (pin7) is used as a I/O select line. When the $\overline{STROBE}$ line is low and the selected address is present on the address lines A2-A7 the output (pin 9) will go high. This signal combined in a NAND gate with the I/O sync signal is used to bring the FD1771 CS (Chip Select) line to its active low state, thereby selecting the chip. Address lines A0 and A1 are used to select the appropriate registers (depending on the state of the Read Enable and Write Enable lines). The register selection is shown again in Table 1.

A1	A0	READ	WRITE
0	0	Status REG	Command REG
0	1	Track REG	Track REG
1	0	Sector REG	Sector REG
1	1	DATA REG	DATA REG

TABLE 1

The $\overline{RE}$ (Read Enable) and $\overline{WE}$ (Write Enable) lines can be controlled by DATA-IN and DATA-OUT STROBES. These controls signals must be inverted as the Read and Write Enable inputs are active low. The systems Master Reset (MR) signal should be inverted and applied to the $\overline{MR}$ input. This will reset the chip when the system comes up. After all voltages are stabilized to both the device and the drive, $\overline{MR}$ should go high. At this point a Restore command will be executed regardless of the state of the Ready input from the drive.

The 2 MHz clock required by the FD1771 can be supplied by the 02 clock signal. This signal should be buffered, of course. DRQ and INTRQ should be connected to the computer interrupt circuitry. As these lines are open-drain outputs they require 10K pull-up resistors to +5 for TTL compatibility.

Figure 2 shows the chip to Floppy interface. As the FD1771 uses active low inputs for $\overline{WPRT}$, $\overline{WV}$, $\overline{TROO}$, & $\overline{IP}$ the signals coming from the Perter Floppy must be inverted, in this case using 7417. The Ready signal is provided by the DOOR OPEN output and no inversion is required.

Outputs from this FD1771 to the Floppy in many cases will have to be conditioned with one shots on other timing methods. The Pertec requires that erase current continue to flow for a specified period after the end of the Write Enable. For this reason the R-C network is used at the input of the 7417 driving the TRIM ERASO line. The Trim Erase signal is derived, by inversion from the Write Enable signal.

As pointed out earlier the Pertec requires a STEP-IN or STEP-OUT command. As the FD1771 provides STEP & DIRECTION 74(S139 and buffers (7416)5−) are used to derive a appropriate STEP commands. If a 74(S139) is not available simple gates may be used to

derive the following signals STEP IN = STEP. DIR STEP. OUT = STEP. DIR This can be implemented using a pair of 2 input AND gates an inverter and the 7416 buffer Head Load is derived by inversion from the HLD signal. A 74LS123 one-shot is used to lengthen the pulse to HLT (Head Load Timing) in order to allow the 40 msec timing requirement of the Pertec Floppy. The WRITE DATA INPUT provides the bit serial write data pulses that control the switching of the write current in the head. The write electronics must be conditioned for writing.

For each high to low transition on the Write Data line, a flux change is produced at the (write) head gap. This will cause a flux change to be stored on the medium.

The frequency modulation type encoding technique is normally used in which data and clock form the combined Write Data signal. It is generally recommended that the repetition rate of the high to low transitions when writing all zeros be equal to the nominal data rate ± 0.18. The repetition rate of the high to low transitions when writing all ones should be equal to twice the nominal data rate ± 0.18.

A 74LS123 One-shot is used to provide the required in signal encoding. TP the Read Data Output line transmits the readback data to the controller. It provides a pulse for each flux transition recorded on the medium. The Read Data output line goes true (low) for a duration of 200± 50 nanoseconds for each flux change recorded on the medium.

The Read Data pulses are inhibited if either the Write Enable signal or the Erase Enable signal is true (low).

Since a data separation circuit is not provided in the Pertec FD 400 disk drive, there is no restriction on the type of encoding technique used as long as certain read amplifier bandwidth limitations are not exceeded.

It is the property of the magnetic recording that the flux transitions recorded on the magnetic medium undergo time distortion during playback. The amount of distortion becomes more pronounced at the higher recording densities. This time distortion associated with the magnetic recording is also known as the peak shift effect because it has the tendency to shift the analog peaks in the read amplifier output.

The double frequency type recording technique is generally recommended for the Pertec FD 400 disk drives. When this technique is used with the bit density of 3248 bits per 250000 bits per second, the maximum time distortion that any flux transition recorded on the medium experiences due to the effects of peak shift and speed variations of the disk drive is 400 nanoseconds from its true position.

Empirically it can be shown that certain bit patterns produce more peak shift than others. Figure 3(a) shows the flux pattern which produces the worst case peak shift when the double frequency recording technique (not including missing clock situations) is used with a data rate of 250000 bits/second.

An address mark method is often used to divide the disk surface into a number of sectors. A unique address mark pattern containing the missing clock situations is written preceding a data field. Figure 3(b) shows the flux transition pattern which produces the worst case peak shift with a data rate of 250000 bits/second.

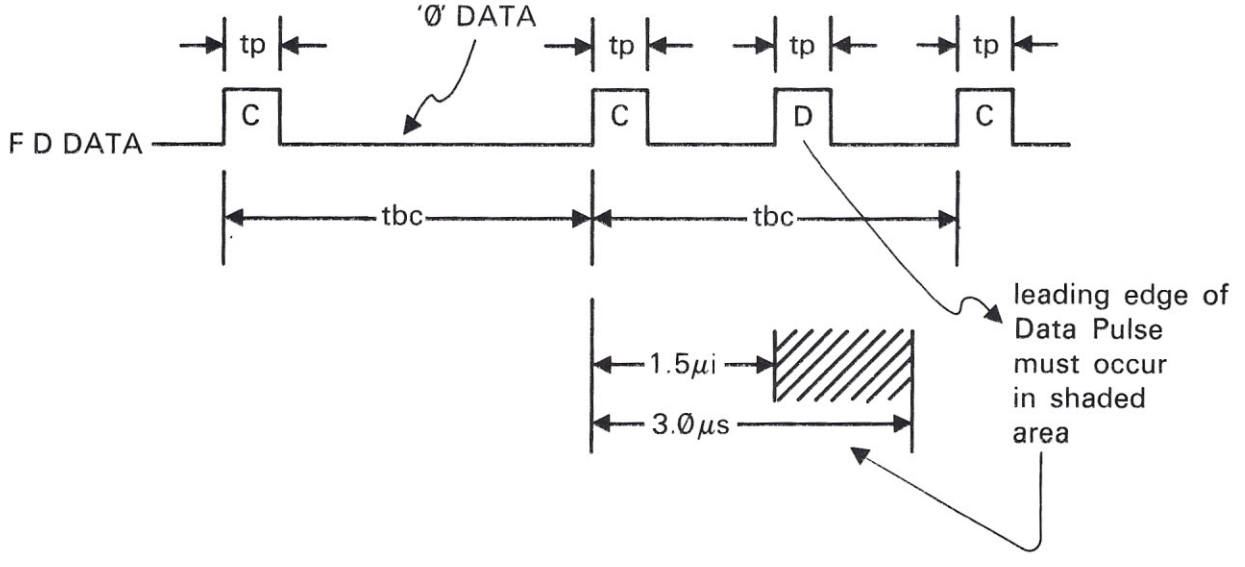
Any decoding circuit designed to recover the data recorded on the disk must take into account the following parameters which adversely affect the decoder margins.

1. Speed variations of the disk drive.
2. Peak shift in the read back signal.

The leading edge of the Read Data output pulses represents the true positions of the flux transitions on the disk surface. The trailing edge of the Read Data output pulses must never be used to determine the true positions of the flux transitions as it reduces the decoder margins.

It is recommended that the Write Data input line be disabled in addition to the Write Enable line during the read operation.

It is good practice to design Data Decoder circuits so as to ensure that the contribution of the circuit to decoder tolerances is negligible compared to peak shift



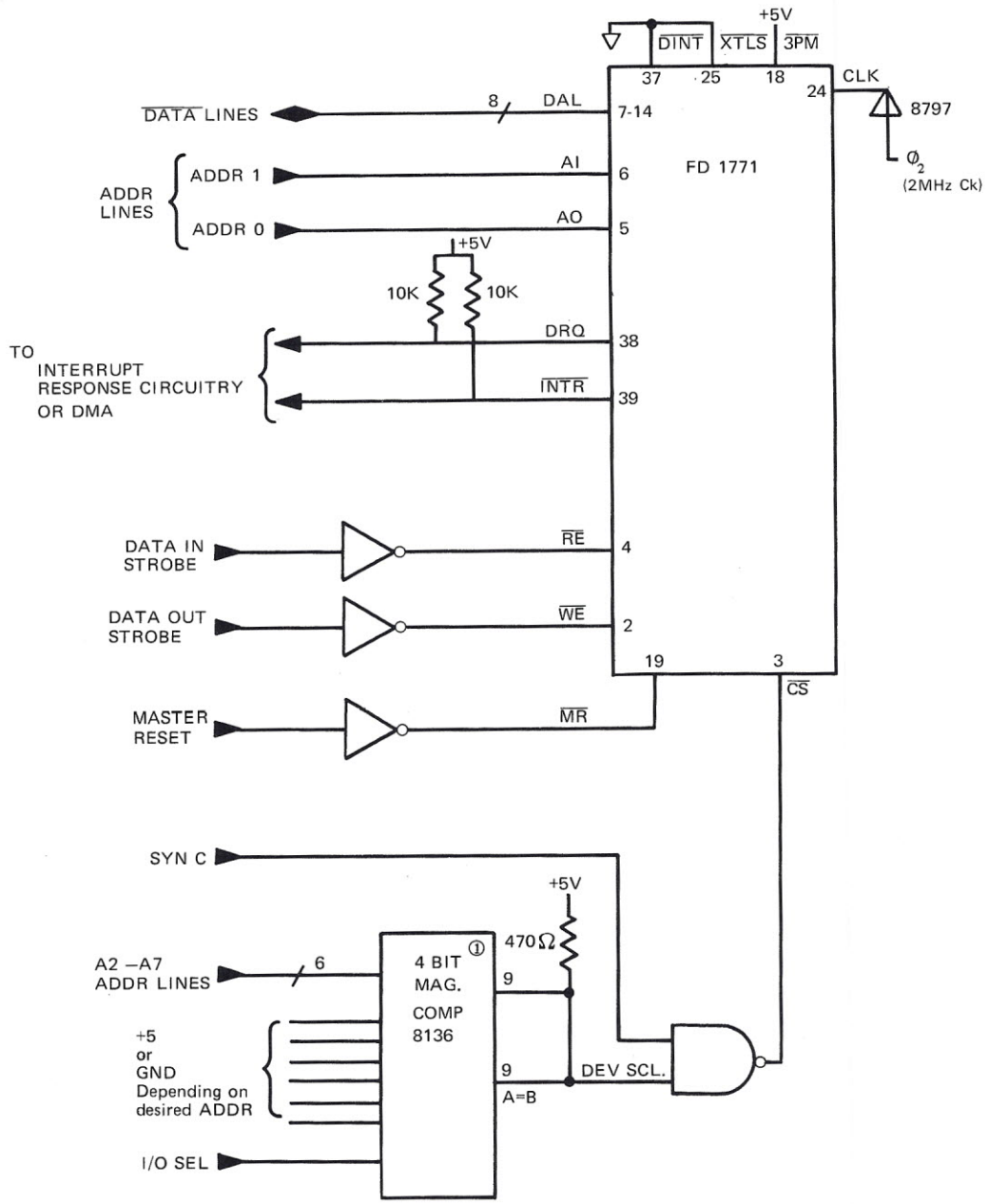
and speed variation effects.

For the typical system shown here a phase lock loop circuit is used to generate clock and data.

The phase lock loop shown in Figure 4 is one suggested by Motorola and is treated in detail in their Application Note AN-535, Phase-Locked Loop Design Fundamentals. In general the lower 4 bit counter supplies a 16 time clock reference input to one side of a phase decoder. The other side of the phase decoder comes from a counter which determines the clock and data window and which synchronizes to the clock bit from the diskette. Any difference between expected clock position and actual received clock position will modify the window counter. This will then result in a phase difference at the MC4044 circuit which is filtered and applied to the MC2024 VCO to speed up or slow down the sample clock.

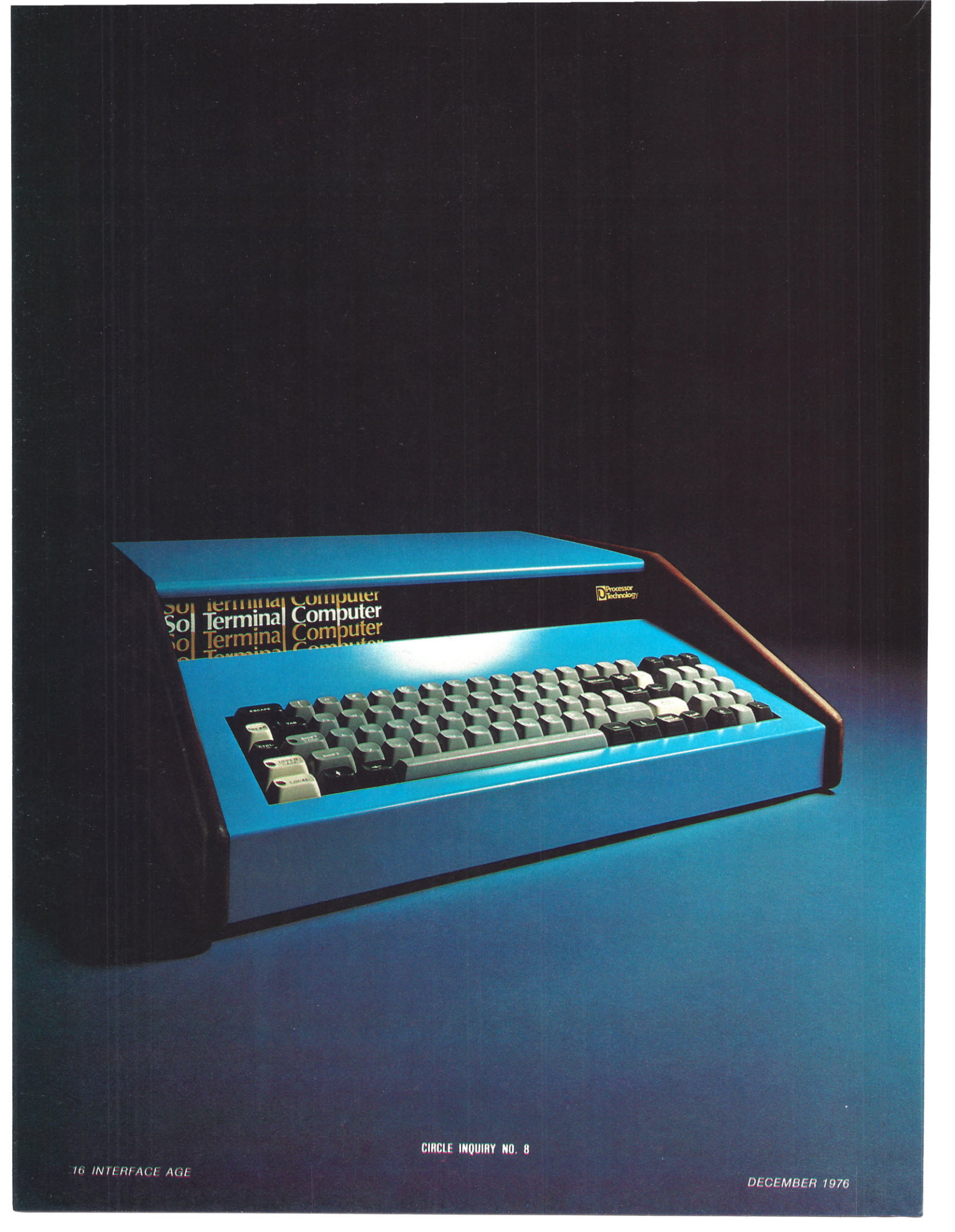
Most drives supply separated data and clock outputs which are normally sufficient for inputs to the FD1771. The user should compare the timing of these signals with those required by the FD1771 as detailed in the FD1771 Data Sheet.

The signals must meet the timing relationships shown in the following Figure A.



NOTE ① THIS CIRCUITRY MAY BE PART OF AN OVERALL I/O SELECT DECODING SYSTEM FOR ALL PERIPHERAL DEVICES.

FIGURE 1 PROCESSOR TO FD1771 INTERFACE



CIRCLE INQUIRY NO. 8

Sol Systems put it all together. One source for hardware and software. One source for engineered compatibility of computer and peripherals. That's the Sol plan.

Though the microprocessor made the powerful small computer possible, a lot of folks found out early efforts in the marketplace were selling the sizzle a lot more than the steak. After an initial investment of several hundred dollars, you ended up with some nice parts, but no memory of any kind, no I/O devices or interfaces, no display, printout or software.

The Sol plan ends all that. Processor Technology takes the position that it's far better to be right than first. So let's get down to the Sol no tricks plan.

For $995 in kit form, the first complete small computer

Standard is a basic word at Processor Technology. The Sol-20 has more standard features than any other small computer we know of. Here's what you get.

8080 microprocessor* 1024 character video display circuitry* 1024 words of static low-power RAM* 1024 words of preprogrammed PROM* a custom, almost sensual 85-key solid-state keyboard* audio cassette interface capable of controlling two recorders at 1200 baud* both parallel and serial standardized interface connectors* a complete power supply* a beautiful case with solid walnut sides* software which includes a preprogrammed Prom personality module and a cassette with Basic-5 language plus two sophisticated computer video games* the ability to work with all S-100 bus (Altair 8800/IMSAI/PTC) products.

There are no surprises. Everything you need to make it work is here. In kit form, nominal assembly time from our fully documented instructions is four to seven evenings.

Or start with the Sol-PC for just $475

You can begin your Sol system with the all on one board Sol-PC kit. It has all the memory and interface electronics including video display, keyboard interface, audio cassette interface, all necessary software and the ability to accept the full Processor Technology line of memory and interface modules. Use the Sol-PC as the basis of a microcomputer, low cost CRT terminal or editing terminal

The Sol plan, completely expandable.

By filling the basic main frame with tailor made Processor Technology plug-in PC boards, you can really expand the computing power and flexibility of your Sol-20 Personal Computer.

New items are being announced frequently, but right now, here are some of the things you can add to your Sol-20. The ALS-8 Firmware module is an assembly language operating system to give you the power to develop and run programs. Use it to quickly write, edit, assemble, de-bug and run your own programs. Some say it's the most useful software development on the market today, but modesty prohibits.

And when it comes to add-on memory boards, you've come to the right place. We've probably got more than anyone else. Choose from 2K ROM or 4, 8 or 16K RAM (read all about the 16KRA board on the last page of this ad). The PT 2KRO will accept up to eight 1702A or 5203Q erasable, reprogrammable memories (EPROM's) with the ability to store in a non-volatile fashion up to 2048 eight-bit words.

Our read/write memories are the industry standards for high reliability. We know, because we have literally scores of customer letters saying "Your memory modules work and keep on working."

A full line of Sol-20 tailored peripherals

No computer can do the full job without the right set of peripheral gear. PT has



CIRCLE INQUIRY NO. 10

sought out the best manufacturers of peripheral equipment and worked with them to give you a choice of quality so you can get the most out of your Sol-20. Choose from line and serial printers, perforated tape readers and punches, floppy disk memories, black and white or color graphics displays, A/D, D/A converters and more.

Software, the Computer Power Essential

A big part of making the first complete small computer is providing you with a wide range of easy to use, easy to obtain, low cost software. For the Sol-20, we've developed a whole group of offerings. And more are on their way.

Sol Systems Price List

(prices are net, effective Dec. 1, 1976)

SOFTWARE

ITEM with manual	Source	CUTS cassette	Paper tape
BASIC 5 software #2	yes	**	$19.50
8K BASIC	no	$29.00	$37.00
New 8080 Focal	no	$14.50	N/A
TREK 80 video game	no	$ 9.50	$14.50
GAMEPAC 1 video games	no	$ 9.50	$14.50
MATHPACK video calculator	yes	$14.50	$19.50
ASSEMBLER software #1	yes	$14.50	$19.50

**CUTS cassette of BASIC 5 is included FREE with all orders for Sol units or CUTS cassette interfaces. Additional cassettes available for $14.50.

Sol system owners be sure to note Sol system on your order. These special versions use less code and provide easier loading along with more convenient operation. SOLOS, SOLED and CONSOL all have provision for the special versions.

All Processor Technology software is distributed on an individual sale basis for personal use. No license to copy, duplicate or sell is granted with this sale. Each software package has been copyrighted by Processor Technology and all rights therein are reserved.

Sol Terminal Computers — Kit Price

SOL-PC SINGLE BOARD TERMINAL COMPUTER™ — **$475.***

SOL-10 TERMINAL COMPUTER™
Sol-PC with case, power supply and 70 key solid state keyboard. — **$795.***

SOL-20 TERMINAL COMPUTER™
all features of Sol-10 with larger power supply, 85 key solid state keyboard, fan, and five slot expansion backplane. — **$995.***

*Sol prices include CONSOL Personality Module. If SOLED Intelligent Editing Terminal Module or SOLOS Standalone Operating System Module is desired instead, add $100. If ordered separately, personality modules are $150 each.

Mass Storage Systems

Helios II Disk System™
includes dual PerSci 270 floppy disk drive, cabinet, fan,S-100 bus compatible controller, power supply, system diskette with complete PTDOS software — **$1895** **$2295**

Memory Modules	Kit	Asmbld.
ALS-8 PROM Resident Assembly Language Operating System	—	$425
SIM-1 Interpretive Simulator add-on option for ALS-8	—	$ 95
TXT-2 Text Editing add-on option for ALS-8	—	$ 95
2KRO Erasable PROM module	$ 65	$ 89
4KRA 4096-word Low Power Static RAM	$159	$195
8KRA 8192-word Low Power Static RAM	$295	$375
16KRA 16384-word Dynamic RAM	—	$529

Interface modules

3P+S Parallel/Serial I/O module	$149	$199
CUTS Computer Users Tape System cassette interface	$ 87	$119
VDM-1 Video Display Module	$199	$295

See your nearest dealer or contact us directly. Address Processor Technology, 6200 Hollis Street, Emeryville CA 94608, Phone 415/652-8080.

Processor Technology Corporation

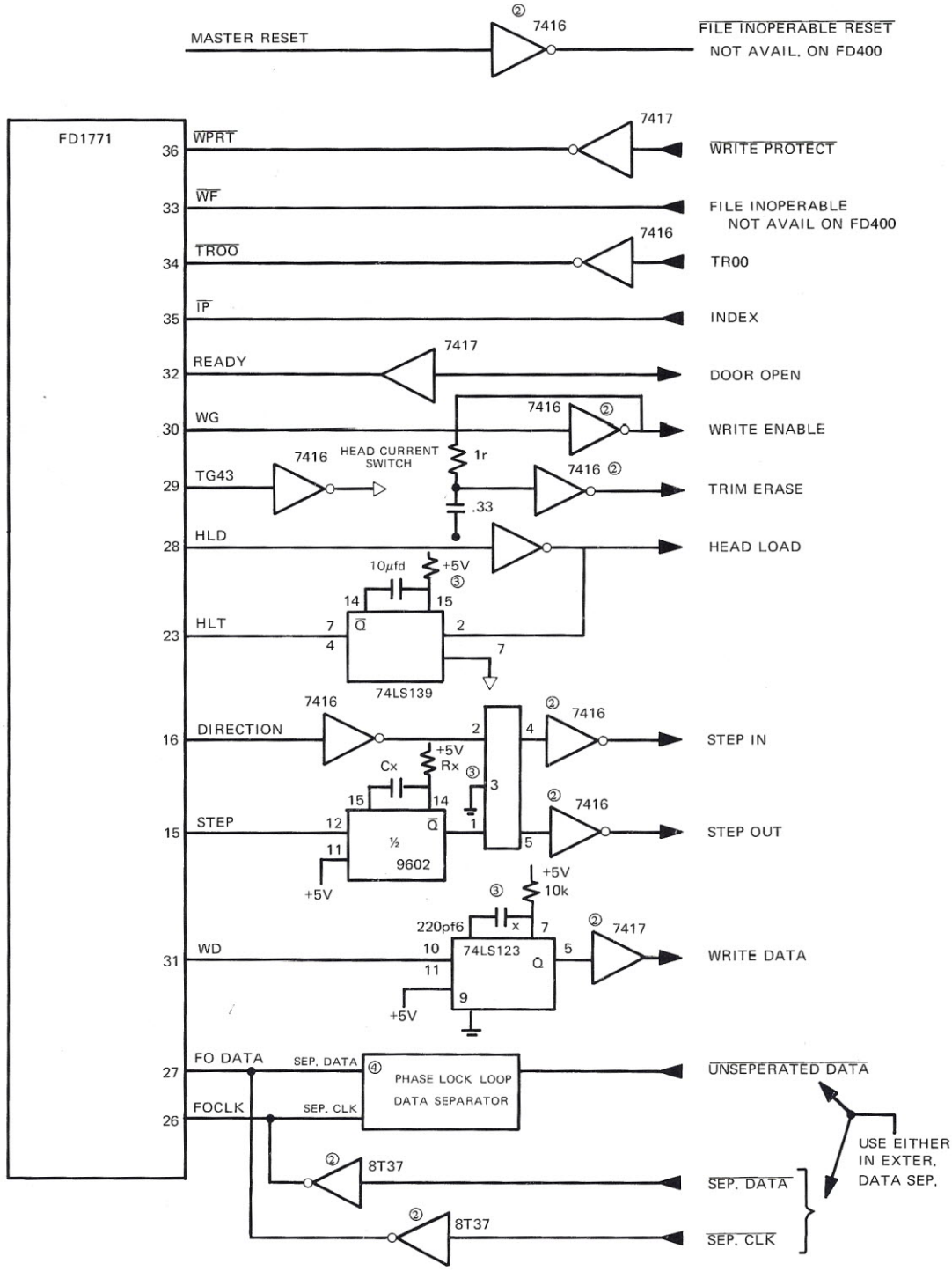
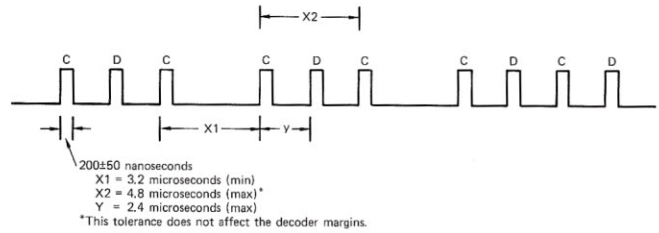


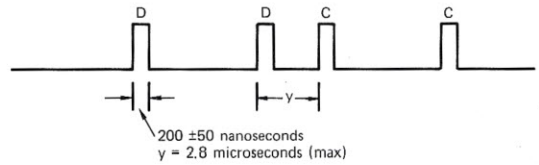
FIGURE 2. FD1771 TO FLOPPY DRIVE INTERFACE

NOTE ②SEE THE FLOPPY DRIVE SPECIFICATIONS FOR RECOMMENDED INTERFACES. SHOWN IS A TYPICAL INTERFACE. ALL LINES SHOULD BE TWISTED PAIRS.

③THE VALUE OF Rx AND Cx ARE CHOSEN TO IMPLEMENT INTERFACE PULSE WIDTH REQUIREMENTS. TYPICAL VALUES ARE:
HLT = 40 MSEC, $\overline{\text{STEP}}$ = 4 µSEC, $\overline{\text{WRITE DATA}}$ = 200 NSEC

④SEVERAL OPTIONS ARE AVAILABLE ON DATA SEPERATION DEPENDANT ON STABILITY OF READ DATA OUTPUT:
1. USE INTERNAL DATA SEPARATION CHIP (REQUIRES VERY STABLE DATA)
2. USE SEPARATED DATA AND CLOCK FROM DRIVE
3. USE PHASE LOCK LOOP IF DATA FROM DRIVE IS UNSTABLE





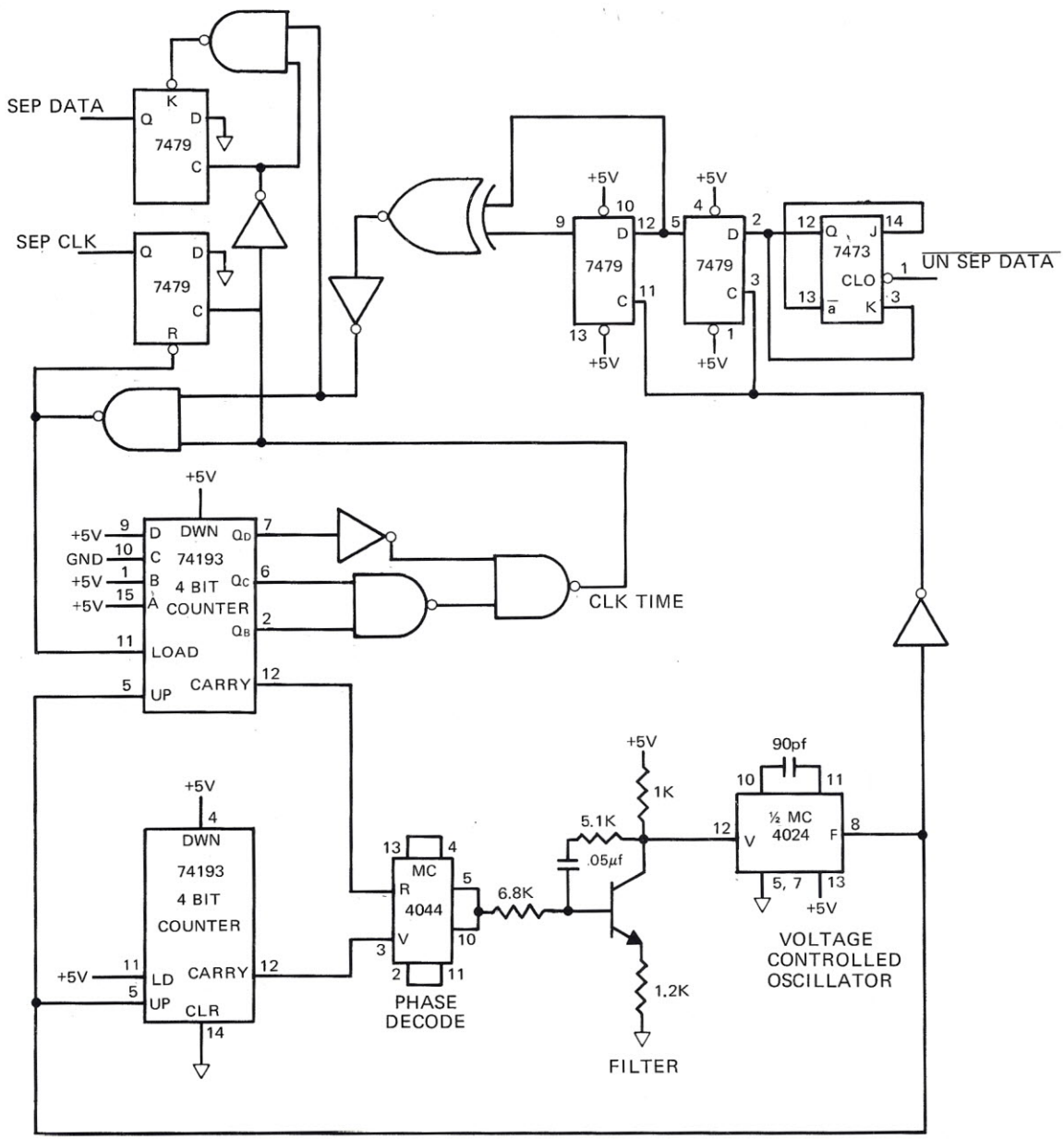


FIGURE 4. PHASE LOCK LOOP DATA SEPARATOR

COMMAND SUMMARY

TYPE	COMMAND	BITS 7 6 5 4 3 2 1 0
I	Restore	0 0 0 0 h V r_1 r_0
I	Seek	0 0 0 1 h V r_1 r_0
I	Step	0 0 1 u h V r_1 r_0
I	Step In	0 1 0 u h V r_1 r_0
I	Step Out	0 1 1 u h V r_1 r_0
II	Read Command	1 0 0 m b E 0 0
II	Write Command	1 0 1 m b E a_1 a_0
III	Read Address	1 1 0 0 0 1 0 0
III	Read Track	1 1 1 0 0 1 0 $\bar{s}$
III	Write Track	1 1 1 1 0 1 0 0
IV	Force Interrupt	1 1 0 1 I_3 I_2 I_1 I_0

The FD1771 can be considered as a specialized microprocessor with its own instruction repertoire. These are listed in the Table.

Some examples of the software control of the Floppy Disk Formatter are shown in the following flow chart. The first example (Figure 5) shows the writing of information onto a particular track and sector. The second example (Figure 6) shows accessing of information from successive sectors. The third example shows how information may be sought by using Track 00 as a table of contents (Figure 7).

FLAG SUMMARY

h = Head load flag

h = 1, Load head at beginning
h = 0, Do not load head at beginning

V = Verify flag

V = 1, Verify on last track
V = 0, No verify

r_1 r_0 = Stepping motor rate

r_1r_0 = 00, 6ms between steps
r_1r_0 = 01, 6ms between steps
r_1r_0 = 10, 8ms between steps
r_1r_0 = 11, 10ms between steps

u = Update flag

u = 1, Update Track register
u = 0, No update

m = Multiple Record flag

m = 0, Single Record
m = 1, Multiple Records

b = Block length flag

b = 1, IBM format (128 to 1024 bytes)
b = 0, Non-IBM format (16 to 4096 bytes)

a_1a_0 = Data Address Mark

a_1a_0 = 00, FB (Data Mark)
a_1a_0 = 01, FA (Data Mark)
a_1a_0 = 10, F9 (Data Mark)
a_1a_0 = 11, F8 (Data Mark)

$\bar{s}$ = Synchronize flag

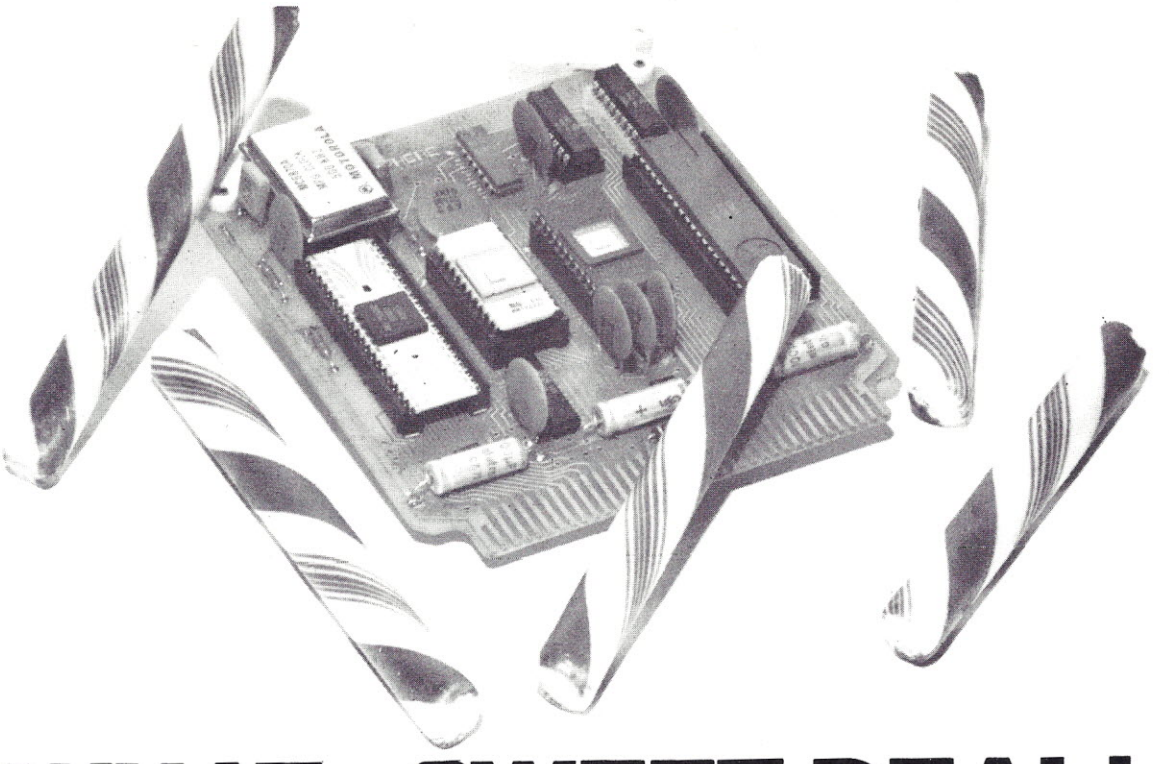
$\bar{s}$ = 0, Synchronize to AM
$\bar{s}$ = 1, Do Not Synchronize to AM

I1 = Interrupt Condition flags

I = 1, Not Ready to Ready Transition
I = 1, Ready to Not Ready Transition
I = 1, Index Pulse
I = 1, Every 10 ms

E = Enable HLD & 10 ms delay
E = 1, Enable HLD, HLT & 10 ms delay
E = 0, Head is assumed engaged & no 10 ms delay

BRANCH TO PAGE 24



WHAT a SWEET DEAL!

Programmable Microprocessor Controller!

$194.00

The Sphere TPU/1 micro computer on a card is designed for use in control environments; whether it be personal or business. TPU is an expandable CPU on a 4.4X4.9 inch edge connector board with the Motorola 6800 microprocessor, a 6820 parallel interface, 256 or 512 bytes of EPROM, 2048 bits of static RAM and a crystal controlled clock driver. You can program the read only memory with special instructions to meet your own needs or buy our programmed ROM'S. The static memory is expandable to 32K and you can control teletype or other I/O.

The TPU has a 72 pin edge connector with all the necessary signals to interface to almost any device. Use it to operate your sprinkling system, lights, heating/cooling system, security system or even control your electric train. The applications are limitless. The TPU/1 is completely assembled and tested; includes schematics and manual. FOR $194 ITS ONE SWEET DEAL!

SPHERE CORPORATION

Dept. 104 P. O. Box 129
Bountiful, Utah 84010

(801) 292-8466

Please send me ____ Sphere CRT interface kits.
Enclosed Check/Mastercharge/Bankamericard

Amount $ _____ Card No. _____
Name _____
Address _____
City _____ State & Zip _____
Limited offer, prices subject to change • Allow up to 30 days for delivery.

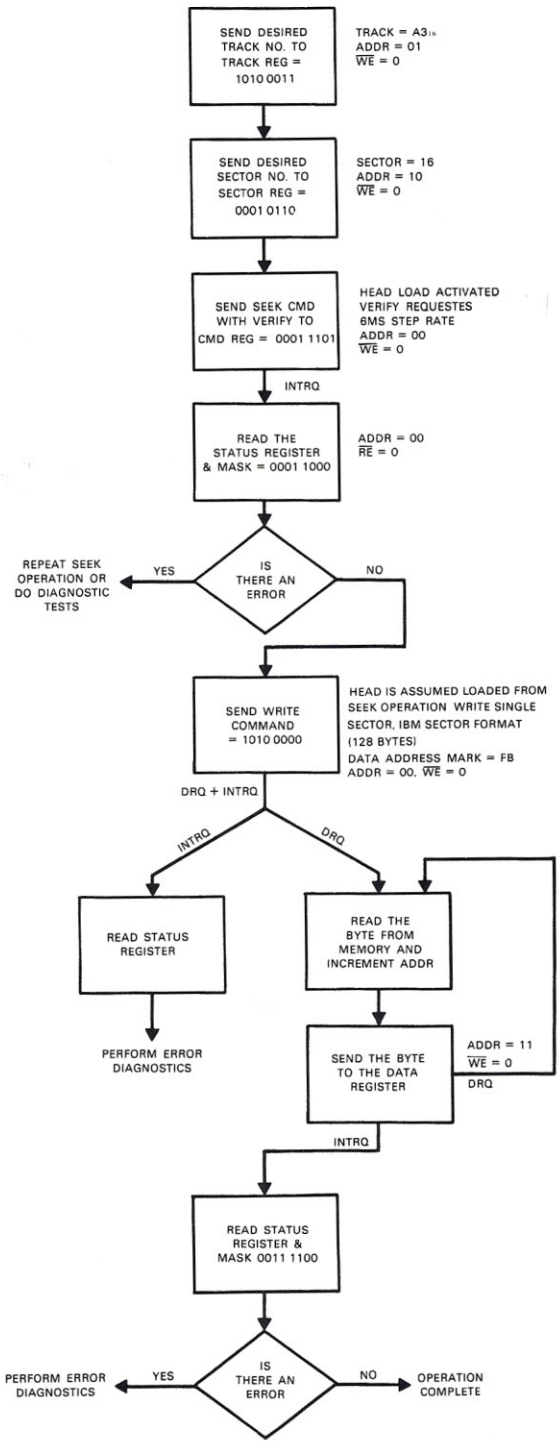


FIGURE 5. WRITING DATA

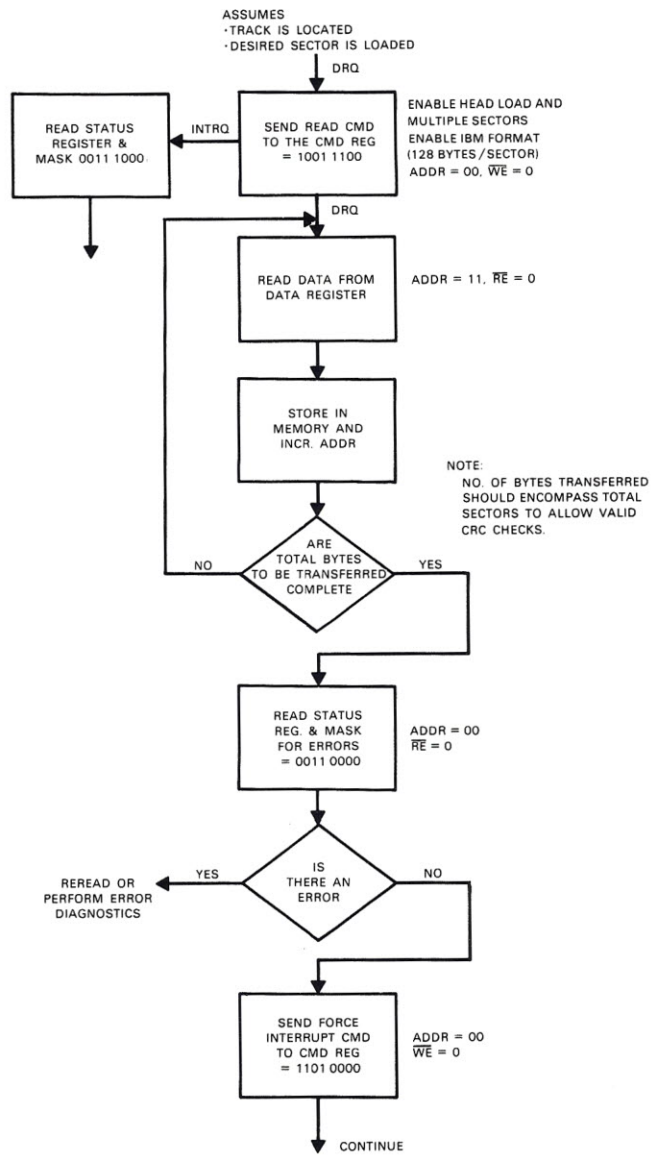


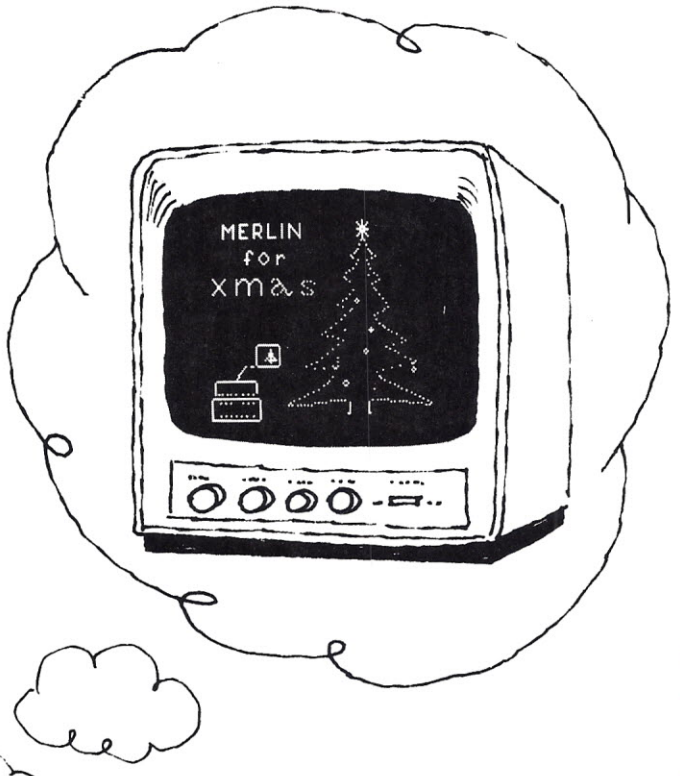
FIGURE 6. READING SUCCESSIVE SECTORS OF DATA

HAVE A MERLIN CHRISTMAS ! ! !

If your favorite computerist has an 8080 bus system, what better way to say Merry Christmas than with a MERLIN Video Interface? MERLIN is not just a superb character display . . .

MERLIN is a whole system . . .
MERLIN is a text display,
a high density graphics display,
a keyboard interface,
a serial I/O port,
a RAM/ROM memory and,
an intergrated and expandable
software package.

MERLIN is a gift that keeps giving. MERLIN's keyboard and I/O connector allows the MERLIN owner to add a variety of Miniterm hardware expansion products. MERLIN's ROM software will turn your computer system into a professional software development tool. Give your favorite computerist (yourself, perhaps?) a MERLIN for Christmas.



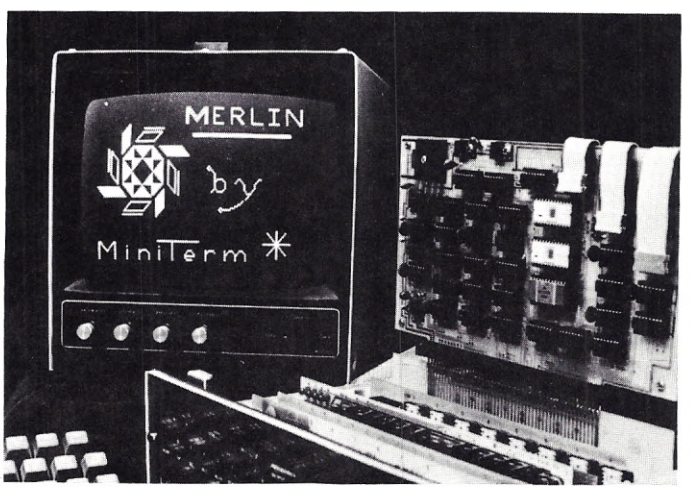


THE INTELLIGENT VIDEO INTERFACE

ROM Monitor/Editor software makes your computer into a professional software development system. User Manual contains full listing.

Altair/IMSAI Plug-in Compatible.
Graphics: 160H or 80H by 100V.
ASCII: 40 characters by 20 lines.
Programmable Display Format.

Also coming are MERLIN add-ons: 1500 baud cassette unit, game controller, super dense graphics, joystick interface, *and* more interface boards such as Modem and cassette with ROM software.



An assembled, tested MERLIN is *only* $349; in kit form, which includes PC boards, IC sockets, User Manual and all parts except memory MERLIN is *only* $249. The Monitor/Editor (MBI) ROM, 2K X 8, plus 256 X 8 RAM which plugs into MERLIN is $39.95. A User Manual is available separately and deductable from your MERLIN order, for $8.00. Master Charge and BankAmericard accepted. For phone orders and delivery schedule call (617) 648-1200.

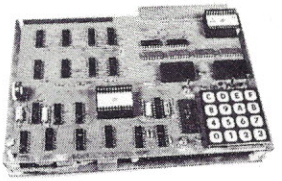
All prices subject to change without notice.

CIRCLE INQUIRY NO. 13

MiniTerm Associates, Inc.

Box 268, Bedford, Mass. 01730

1702A MANUAL EPROM PROGRAMMER



Features hex keypad, two digit hex address and two digit hex data display. Controls include load, clear, go! (step), key/copy, data in/ data out, and counter up/ down. Profile card includes high voltage pulse regulator, timing, 8 bit address and 8 bit data drivers/receivers. Two 6½" x 9" stacked cards with spacers. Allows programming in 20 minutes — copying in 5 minutes. Requires +5, –9, and +80 volts.

ASSEMBLED $299.95
KIT $189.95

NOW

The best of two worlds... use our 1702 EPROM programmer as a manual data/address entry programmer . . . or connect it to your processor.

IMSAI/ALTAIR computer interface (requires 3 output ports, +1 input port) and software $49.95

Briefcase unit with power supplies and interface connectors (assembled and tested only) $599.95

ANNOUNCING

Our NEW 16K Byte Pseudo-Static, IMSAI/ALTAIR compatible RAM. Single card slot. Uses less power than equivalent low power RAM. All memory chips socketed. Uses all prime, factory fresh ICs. High quality, two-sided, through-hole-plated circuit board. Crystal controlled, totally invisible refresh system requires NO software management. Just plug it in and use like STATIC memory.

Complete kit $349.95
Assembled, tested, and burned in $549.95

ASSOCIATED ELECTRONICS
12444 Lambert Circle • Garden Grove, CA 92641
(714) 539-0735

CIRCLE INQUIRY NO. 14

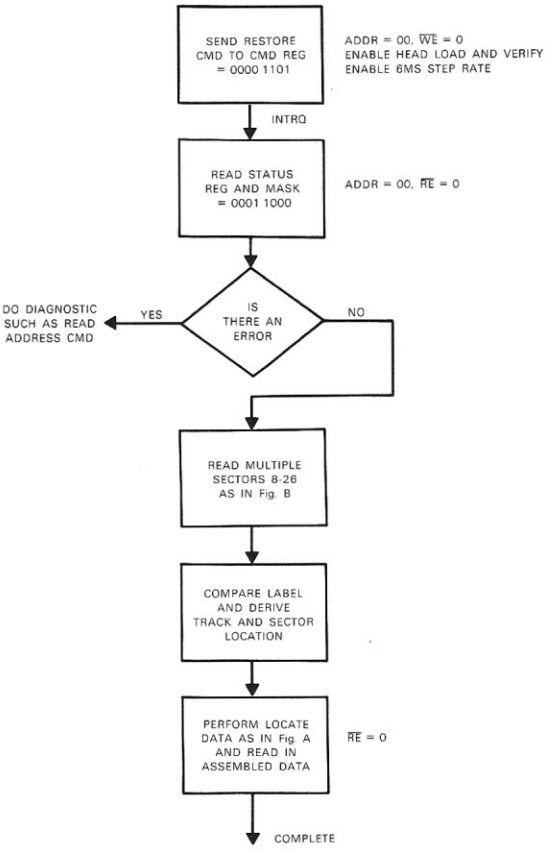


FIGURE 7. USING TRACK 00 AS TABLE OF CONTENTS

ADMIT IT! YOU CAN USE OUR BOARDS

CL2400
Real Time Clock

- Self-contained hardware clock
- Programmable interrupts
- Uses:
 - 24 Hour Clock
 - Software Timer
 - Event Timer

KIT - **$98**

ASSEMBLED - **$135**

PC3200
Power Control System

- Controls AC power outlets with remote power control units
- 1 to 32 independently addressable control channels
- Optically isolated, current limited, low voltage control lines
- No AC power on logic board

Write for details and prices

Both are ALTAIR and IMSAI compatible, and accessible through most BASIC's.

comptek
"Real World Electronics"

P.O. Box 516
La Canada, Ca. 91011
(213) 790-7957

CIRCLE INQUIRY NO. 15

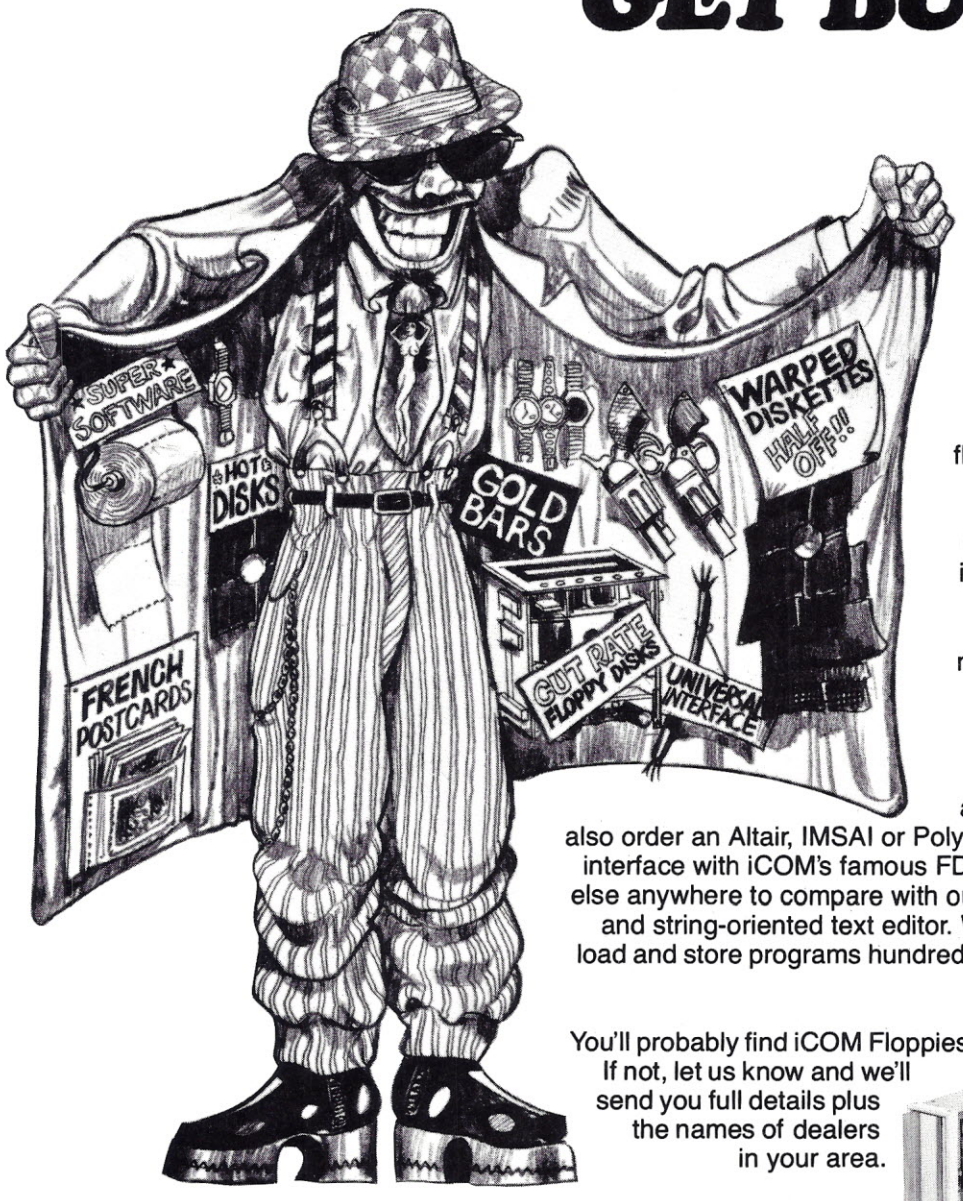
CALL FOR INFORMATION ON BASIC PROGRAMMING LANGUAGES

INTERFACE AGE is conducting a survey on the characteristics and programming power of Microcomputer BASIC conversational programming languages. This survey includes Tiny BASIC (TB), Tiny BASIC Extended (TBX), Standard BASIC (SB), Standard BASIC Extended (SBX) and Business BASIC (BB) languages. One of the main objectives of this survey is to highlight the correlation between BASIC languages in order to provide insight for running a BASIC application program on any of the different BASIC languages. If you have developed, helped develop or modified any BASIC type of programming language for any Microcomputer please contact or send hard copy of grammar, users manual and any supporting documentation to:

Robert A. Stevens
Software Editor
INTERFACE AGE
2361 E. Foothill Blvd.
Pasadena, Calif. 91107
or call (213) 449-1655

Please include your home and work telephone numbers (for coordination) with all correspondence.

Be Careful Whose Floppy Disk System You Buy For Your Personal Computer. "YOU COULD GET BURNED"

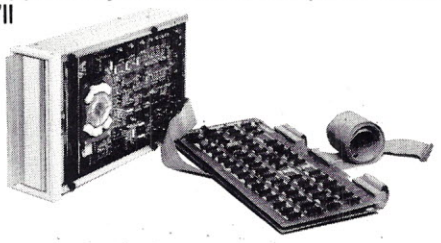


With garage operators all over the place, you can easily get burned when you buy a Floppy Disk system for your personal computer. That's why users everywhere are jumping on the iCOM bandwagon.

You can choose iCOM with complete confidence. We've been building microcomputer floppies for more than two years. Thousands of systems are operating perfectly in the field. Our prices are low. Our delivery is fast. We're part of Pertec, one of the largest manufacturers of computer peripherals, which means we'll be around to service your system if it ever needs it.

Our Frugal Floppy is just $1,195 including disk drive, controller and cables/connectors. You can also order an Altair, IMSAI or Polymorphic bus-compatible plug-in interface with iCOM's famous FDOS-II software. There's nothing else anywhere to compare with our disk-based macro-assembler and string-oriented text editor. With our Frugal Floppy, you can load and store programs hundreds of times faster than with paper tape, cassette or teletype.

You'll probably find iCOM Floppies at your favorite computer store. If not, let us know and we'll send you full details plus the names of dealers in your area.



icom® MICROPERIPHERALS™

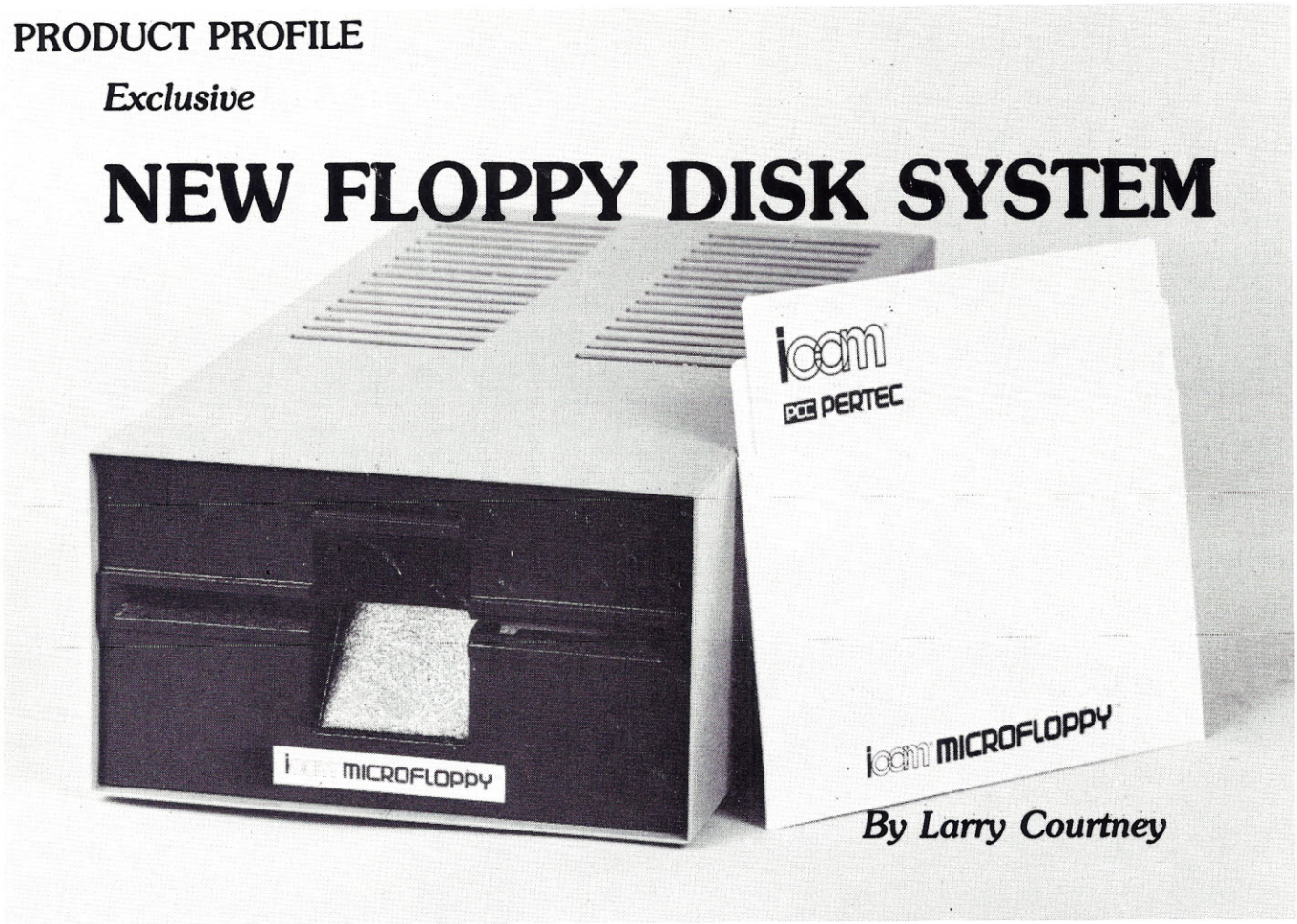
PCC PERTEC a division of Pertec Computer Corporation

6741 Variel Ave., Canoga Park, CA 91303 U.S.A.
(213) 348-1391 TWX 910-494-2788

PRODUCT PROFILE

Exclusive

NEW FLOPPY DISK SYSTEM



By Larry Courtney

iCOM®'s new Microfloppy™ Disk System is a brand new Floppy Disk System specifically designed for the personal computer user. It's smaller, using the new 5¼ inch diskette, and is priced at $995 including disk drive and it's associated electronics, DC power supply, cabinet, controller/interface card, power cord, fuse and all cables and connectors. Also included on diskette is iCOM's FDOS-M software. In addition, a Disk Basic software package is available.

The controller/interface card, which contains some 42 IC's including LSI components, has all of the electronics necessary to interface the Disk Drive and the Microcomputer. Thus, the system is 100% plug compatible with the Altair 8800, the Poly 88, the IMSAI 8080 and other microcomputers using the S-100 BUS format.

The Microfloppy can be purchased from iCOM dealers in either of two ways. For $995, the user receives the controller/interface card in kit form. Sockets are provided, making it easy to assemble and to maintain. For $1095, the controller/interface card is delivered fully assembled and tested. In either configuration, the power supply must be bolted to the chassis.

The LSI controller chip uses IBM format standards and has features such as auto seek, auto CRC, address mark detection, etc. It's truly a hard-oriented controller, with little real time software required to control the disk. The controller can handle up to 3 disk drives, daisy chained and automatically selected by software.

Inputs to the disk drive from the controller are composite clock and data formatted. Output signals are composite clock and data which are then separated by the controller. The iCOM Microfloppy Controller electronics use phase locked loop techniques, usually associated with expensive disk drives.

The low cost 5¼ inch single side recording diskette, which experts feel will become the industry standard for microcomputers, features "write protect," and the drive has a door interlock which insures that the diskette is inserted correctly. The diskette has 35 tracks with 16 sectors to a track. Each sector contains 128 bytes. In a formatted mode, 70,000 bytes are available on a diskette.

FDOS-M Software

iCOM's FDOS-M software includes a macro assembler and a string-oriented text editor. It's features include named variable length files, auto file create, open and close, multiple file merge and delete . . . Under FDOS-M, programs stored on the diskette are assigned 5 character names by the operator. Up to 175 named files (programs) can be stored on a single diskette, each available within seconds. Each file can be as small as 128 bytes or as large as the entire diskette.

Compared to a cassette, efficiency using iCOM's Microfloppy is increased by an almost unbelievable amount. Programs can be loaded in a few seconds, correction of a source program of several thousand characters and be made and a new corrected file stored on diskette in less than a minute. Assembly of source programs is reduced from hours to minutes.

Assembly of any of the 175 files can be reached in just 1.5 seconds. No matter how you look at it, the iCOM Microfloppy is from 10 to 15 times faster than a cassette.

Some of the things that can be done under FDOS-M.

LIST —	Lists all files on the diskette by name, size, attribute and disk location.
CREATE —	Used to manually establish a file of a given size under a given 5 character name. The assembler and editor automatically create files of a given name at exactly the right size.
MERGE —	Allows any number of files to be combined together as one new file, which is convenient for inserting subroutines, patches, partial assemblies, text editing, etc.
PRINT —	Prints a given file on the print device.
VIEW —	Lists a file on the CRT "n" lines at a time, with the capability of scrolling up and down throughout the file. This is particularly handy for viewing assembly listings on CRT systems without hard copy or for a quick look at any file.

Optional DISK BASIC Software for $50

Users have asked for a disk resident BASIC software package and iCOM has made it available on the Microfloppy for just $50. BASIC, a high level, people-oriented language stands for Beginners All-purpose Symbolic Instruction Code.

One of the important aspects of BASIC, as it applies on the Microfloppy, is its compatibility with FDOS-M, the assembler and the editor. For example, the output of the editor can be used as input to BASIC and vice versa. Using BASIC, the operator can open and close data files, can read and write from/to disk files, and can store and retrieve programs and/or data. BASIC is supplied on the same diskette as the FDOS-M, the assembler and the editor.

The Disk Drive

The disk drive in the iCOM Microfloppy provides low cost data storage with an average access time measured in milliseconds. Average access time is less than ½ second compared to 20 seconds or more for cassettes. Also the transfer rate of 125K bits per second is 80 times the throughput of a typical cassette. The disk also shines when it comes to errors. Soft errors are reduced to 1×10^{8} and hard errors to 1×10^{11}. This is at least two orders of magnitude better than cassette storage.

Summing it up ...

At $995 including drive, power supply, cabinet, controller/interface card, manuals, diskette and software, the iCOM Microfloppy makes it possible for every personal computer user to dramatically increase the efficiency of their system. iCOM Microperipherals™ is part of the Pertec Computer Corporation. They are located at 6741 Variel Avenue, Canoga Park, California 91303. (213) 348-1391.

SPECIFICATIONS — iCOM MICROFLOPPY™

I. FORMAT SPECIFICATIONS

- Medial can be initialized by the user with a wide variety of formats; including the 128 bytes/sector, 16 sectors/track IBM type of format used by the iCOM software.
- 35 tracks/diskette
- Uses 5.25 inch (133mm) diskette

II. PERFORMANCE SPECIFICATIONS

	iCOM System	Maximum
• Unformatted Capacity		
A. Per disk		109,375 bytes
B. Per track		3,125 bytes
• Formatted Capacity		
A. Per Disk	71,600 bytes	89,600 bytes
B. Per track	2,048 bytes	2,560 bytes
C. Per sector	128 bytes	256 bytes
D. Sectors/track	16	10
• Transfer rate:	125,000 bits/second	
• Latency (average)	100 milliseconds	
• Access time		
A. Track to track	40 milliseconds	
B. Average	463 milliseconds	
C. Settling time	10 milliseconds	
• Head load time	75 milliseconds	
• Disk motor start time	1 second	

III. FUNCTIONAL SPECIFICATIONS

• Rotational speed	300 Revolutions Per Minute
• Recording density (Inside track)	2,581 Bits Per Inch
• Flux density	5,162 Flux Changes Per Inch
• Track density	48 Tracks Per Inch

IV. POWER — 115/220VAC, 50/60 Hz

V. DIMENSIONS — 3.80" (965cm) High by 6.10" (15.5cm) Wide by 12.9" (32.77cm) deep

VI. WEIGHT — 8 pounds (3.63 KG.)

VII. FEATURES

- LSI Controller, low power schottky circuits all in sockets
- On board RAM and ROM for minimum overlap
- Phase locked loop data separator for high reliability
- Only 8K memory required for minimum system
- FDOS-M, assembler, editor and basic (opt.)
- Soft sector format (IBM)
- Up to 3 drives per controller
- Drive Write Protect Capability

VIII. INTERFACE/CONTROLLERS

- Altair 8800 and other bus compatible microcomputers
- IMSAI 8080
- Poly 88

$194 for the kaboodle.

whole kit &



the kit $95

the kaboodle $99

The kaboodle is our popular SC/MP Kit microcomputer package: SC/MP microprocessor, ROM, RAM, timing crystal, PC Board, and all necessary drive logic. All for just $99.

The kit is our new, low-cost terminal kit: keyboard display, and special ROM with debug keyboard/display scanning program. All for just $95.

You don't need a $500 development system.

You don't need a $1,000 teletype.

You buy our kit and kaboodle, and you're in business. In microprocessors, video games, home control systems, whatever. For training, for learning, for development.

If you'd like complete information, we'll send it to you for nothing.

Or, if you'd prefer the actual microcomputer and terminal kit, that'll be just $194 extra.

National Semiconductor
2900 Semiconductor Drive, Santa Clara, CA 95051

Gentlemen:

__Please send me more information.
__Please send me a real live SC/MP Kit (ISP-8K/200) $99.
__Please send me a real live Keyboard Kit (ISP-8K/400) $95.
Here's my check. (California residents add 6% sales tax.)

Also available at your local distributor.

Name_____Title_____
Company_____
Address_____
City_____State_____Zip_____

National Semiconductor

AMI 6800 MICROCOMPUTER CHIP SET

By Robert A. Stevens



This article is the first one of a series of four articles covering AMI's S6800 microcomputer chip set, EVK Microcomputer Prototyping boards and EVK prototyping board PROTO & $(RS)^3$ program development software.

The first article in this series covers the S6800 MPU in detail and summarizes the microcomputer supporting IC's in order to lay the ground work for next months article on AMI's EVK Prototyping boards.

AMI's S6800 FAMILY OF MICROCOMPUTER IC's

AMI's S6800 family of microcomputer, IC's is composed of a series of matched MOS large scale integrated (LSI) circuits for, configuring into microcomputer systems. This series of microcomputer MOS LSI functional building block logic circuits include a MPU, ROM, EPROM, RAM, PIA, ACIA, USRT, and Digital Modem Logic circuits.

S6800 — 8-BIT MICROPROCESSOR

FUNCTIONAL DESCRIPTION

S6800 MICROPROCESSOR (MPU) — an 8-bit parallel processor, with the ability to address up to 65K bytes of memory, and execute instructions in 2 microseconds. It is manufactured using N-channel MOS technology and operates on a single +5V power supply. All inputs and outputs are TTL compatible. The MPU has six internal registers, four types of vectored interrupts and 72 basic instructions. The basic instructions can be used in different addressing modes to save instruction execution time and memory space.

FEATURES

- Eight-Bit Parallel Processing
- Bi-Directional Data Bus
- Sixteen-Bit Address Bus — 65536 Bytes of Addressing
- 72 Instructions — Variable Length
- Seven Addressing Modes — Direct, Relative, Immediate, Indexed, Extended, Implied and Accumulator
- Variable Length Stack
- Vectored Restart
- 2 Microsecond Instruction Execution
- Maskable Interrupt Vector
- Separate Non-Maskable Interrupt — Internal Registers Saved in Stack

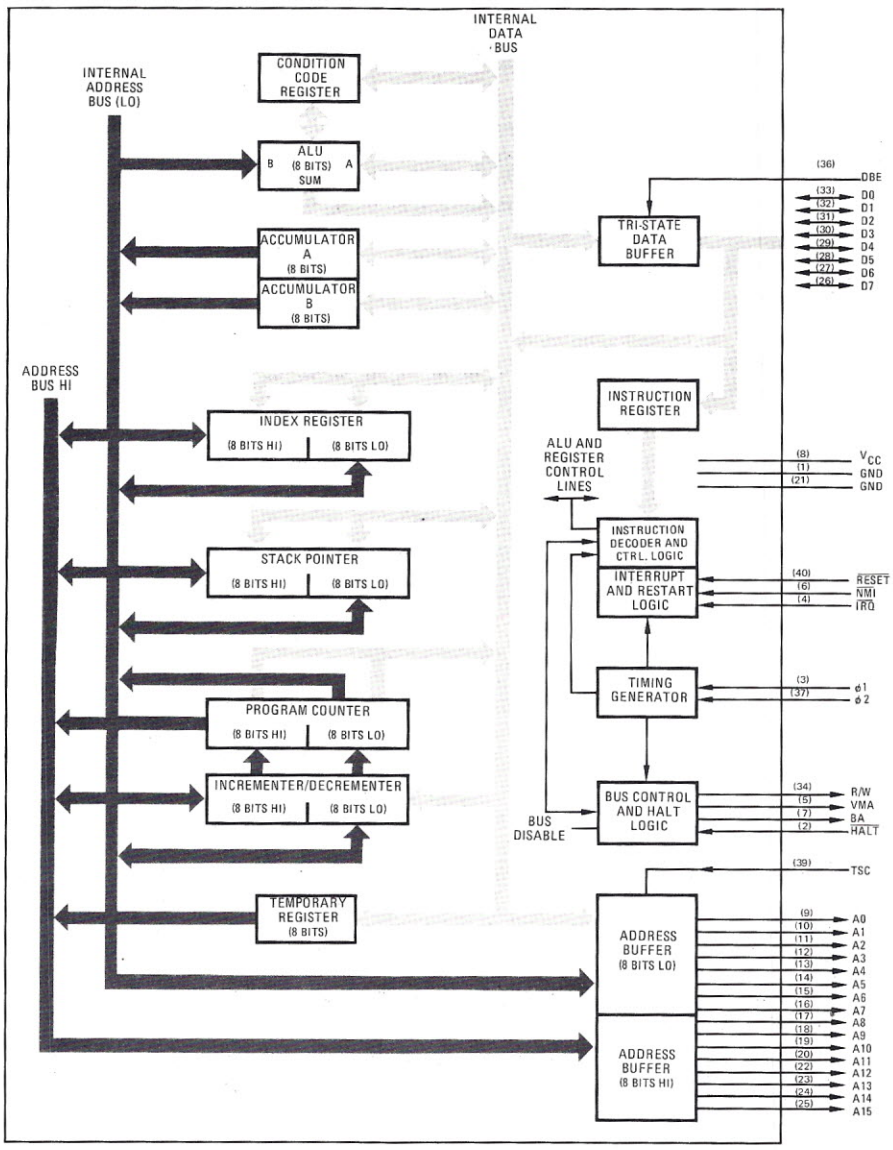


FIGURE 1. BLOCK DIAGRAM OF S6800 MICROPROCESSOR

- Six Internal Registers — Two Accumulators, Index Register, Program Counter, Stack Pointer and Condition Code Register
- Direct Memory Access (DMA) and Multiple Processor Capability
- Clock Rates as High as 1 MHz
- Simple Bus Interface Without TTL
- Halt and Single Instruction Execution Capability

S6800 MICROPROCESSOR ARCHITECTURE

The S6800 Microprocessor (MPU) is an 8-bit parallel processor. It contains an 8-bit arithmetic unit (ALU), two 8-bit accumulators, one condition code register, and three 16-bit address storage registers, all of which are available for program use (see Figure 1). In addition, there are the following non-accessible registers: a 16-bit address incrementer/decrementer, an 8-bit temporary register and an 8-bit instruction register. There is also an instruction decode ROM and cycle control logic, interrupt and restart logic, bus control and halt logic, and a timing generator.

MPU PROGRAM ACCESSIBLE REGISTERS

Accumulators A and B — Two separate 8-bit accumulators that are used to hold operands and results of operations in the ALU.

Index Register — A 16-bit register used for memory address storage in Indexed Addressing operations.

Program Counter — A 16-bit register that holds the current program instruction address. Once the initial program starting address is loaded into the program counter, it is incremented under control of the MPU hardware.

Stack Pointer — A 16-bit register used for storage of the next available location in an external push-down/pop-up stack.

Condition Code Register — An 8-bit register that stores certain results of operations in the ALU. These bits are used as testable conditions for the conditional branch instructions. In addition, one bit position stores the interrupt mask bit and the two high order bits are unused. See Figure 2.

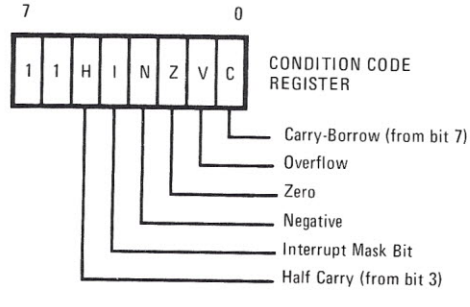


FIGURE 2.

EXTERNAL STACK MEMORY REGISTER — a push-down/pop-up stack that can be located anywhere in RAM and be of any convenient size. It is accessed with the stack pointer address and has several uses. First, it always stores the MPU register contents following an interrupt and return addresses during sub-routine execution. Second, it can also be used by the programmer to store data during program execution.

MPU HARDWARE REGISTERS (NOT ACCESSIBLE BY PROGRAM)

Instruction Register — 8-bit register used to receive and store all program instructions input into the MPU (via the data bus lines D0-D7).

Temporary Register — 8-bit register typically used to store the high order address bits prior to their output from the MPU onto the external address bus lines A8-A15.

Incrementer — 16-bit auxiliary address register, used by the MPU internal control logic, in conjunction with the program counter, to maintain and output the current program address.

MPU INTERNAL BUSSES

Within the MPU all data and address transfers between the registers, as well as to and from the ALU, are made across three internal 8-bit busses. The first is a data bus, the second is an address bus for the low order bits, and the third is an address bus for high order bits.

MPU INTERFACE DESCRIPTION

Signal	Pin	Function
Ø1	(3)	**Clocks Phase One and Phase Two** — Two pins are used for a two-phase non-overlapping clock that runs at the V_{CC} voltage level.
Ø2	(37)	
RESET	(4Ø)	**Reset** — This input is used to reset and start the MPU from a power down condition, resulting from a power failure or an initial start-up of the processor. If a positive edge is detected on the input, this will signal the MPU to begin the restart sequence. This will start execution of a routine to initialize the processor from its reset condition. All the higher order address lines will be forced high. For the restart, the last two (FFFE, FFFF) locations in memory will be used to load the program that is addressed by the program counter. During the restart routine, the interrupt mask bit is set and must be reset before the MPU can be interrupted by $\overline{IRQ}$. $\overline{Reset}$ must be held low for at least eight clock periods after VCC reaches 4.75 volts (Figure 4). If $\overline{Reset}$ goes high prior to the leading edge of Ø2, on the next Ø1 the first restart memory vector address (FFFE) will appear on the address lines. This

location should contain the higher order eight bits to be stored into the program counter. Following, the next address FFFF should contain the lower order eight bits to be stored into the program counter.

VMA (5) **Valid Memory Address** — This output indicates to peripheral devices that there is a valid address on the address bus. In normal operation, this signal should be utilized for enabling peripheral interfaces such as the PIA and ACIA. This signal is not three-state. One standard TTL load and 30 pF may be directly driven by this active high signal.

A0 (9) **Address Bus** — Sixteen pins are used for the address bus. The outputs are three-state bus drivers capable of driving one standard TTL load and 130 pF. When the output is turned off, it is essentially an open circuit. This permits the MPU to be used in DMA applications.

A15 (25)

TSC (39) **Three-State Control** — This input causes all of the address lines and the Read/Write line to go into the off or high impedance state. This state will occur 500 ns after TSC = 2.4 V. The Valid Memory Address and Bus Available signals will be forced low. The data bus is not affected by TSC and has its own enable (Data Bus Enable). In DMA applications, the Three-State Control line should be brought high on the leading edge of the Phase One Clock. The Ø1 clock must be held in the high state and the Ø2 in the low state for this function to operate properly. The address bus will then be available for other devices to directly address memory. Since the MPU is a dynamic device, it can be held in this state for only 5.0 μs or destruction of data will occur in the MPU.

D0 (33) **Data Bus** — Eight pins are used for the data bus. It is bi-directional, transferring data to and from the memory and peripheral devices. It also has three-state output buffers capable of driving one standard TTL load at 130 pF.

D7 (26)

DBE (36) **Data Bus Enable** — This input is the three-state control signal for the MPU data bus and will enable the bus drivers when in the high state. This input is TTL compatible; however in normal operation, it can be driven by the phase two clock. During an MPU read cycle, the data bus drivers will be disabled internally. When it is desired that another device control the data bus such as in Direct Memory Access (DMA) applications, DBE should be held low.

R/W (34) **Read/Write** — This TTL compatible output signals the peripherals and memory devices whether the MPU is in a Read (high) or Write (low) state. The normal standby state of this signal is Read (high). Three-State Control going high will turn Read/Write to the off (high-impedance) state. Also, when the processor is halted, it will be in the off state. This output is capable of driving one standard TTL load and 130 pF.

$\overline{\text{HALT}}$ (2) **Halt** — When this input is in the low state, all activity in the machine will be halted. This input is level sensitive. In the halt mode, the machine will stop at the end of an instruction, Bus Available will be at a one level, Valid Memory Address will be at a zero, and all other three-state lines will be in the three-state mode.

Transition of the $\overline{\text{Halt}}$ line must not occur during the last 250 ns of phase one. To insure single instruction operation, the $\overline{\text{Halt}}$ line must go high for one Phase One Clock cycle.

BA (7) **Bus Available** — The Bus Available signal will normally be in the low state; when activated, it will go to the high state indicating that the microprocessor has stopped and that the address bus is available. This will occur if the $\overline{\text{Halt}}$ line is in the low state or the processor is in the WAIT state as a result of the execution of a WAIT instruction. At such time, all three-state output drivers will go to their off state and other outputs to their normally inactive level. The processor is removed from the WAIT state by the occurrence of a maskable (mask bit I = Ø) or nonmaskable interrupt. This output is capable of driving one standard TTL load and 30 pF.

$\overline{\text{IRQ}}$ (4) **Interrupt Request** — This level sensitive input requests that an interrupt sequence be generated within the machine. The processor will wait until it completes the current instruction that is being executed before it recognizes the request. At that time, if the interrupt mask bit in the Condition Code Register is not set, the machine will begin an interrupt sequence. The Index Register, Program Counter, Accumulators, and Condition Code Register are stored away on the stack. Next the MPU will respond to the interrupt request by setting the interrupt mask bit high so that no further interrupts may occur. At the end of the cycle, a 16-bit address will be loaded

that points to a vectoring address which is located in memory locations FFF8 and FFF9. An address loaded at these locations causes the MPU to branch to an interrupt routine in memory.

The $\overline{\text{Halt}}$ line must be in the high state for interrupts to be recognized.

The $\overline{\text{IRQ}}$ has a high impedance pullup device internal to the chip; however a 3 kΩ external resistor to V_{CC} should be used for wire-OR and optimum control of interrupts.

$\overline{\text{NMI}}$ (6) **Non-Maskable Interrupt** — A low-going edge on this input requests that a non-mask interrupt sequence be generated within the processor. As with the $\overline{\text{Interrupt Request}}$ signal, the processor will complete the current instruction that is being executed before it recognizes the $\overline{\text{NMI}}$ signal. The interrupt mask bit in the Condition Code Register has no effect on $\overline{\text{NMI}}$.

The Index Register, Program Counter, Accumulators, and Condition Code Register are stored away in the stack. At the end of the cycle, a 16-bit address will be loaded that points to a vectoring address which is located in memory locations FFFC and FFFD. An address loaded at these locations causes the MPU to branch to a non-maskable interrupt routine in memory.

$\overline{\text{NMI}}$ has a high impedance pullup resistor internal to the chip; however a 3 kΩ external resistor to V_{CC} should be used for wire-OR and optimum control of interrupts.

Inputs $\overline{\text{IRQ}}$ and $\overline{\text{NMI}}$ are hardware interrupt lines that are acknowledged during Ø2 and will start the interrupt routine on the Ø1 following the completion of an instruction.

MPU EXTERNAL BUSSES

The MPU communicates with its external memory and all I/O devices across an 8-bit bidirectional data bus, D0 through D7, and 16 address lines, A0 through A15. The MPU can be disconnected from either bus by two control signals DBE and TSC. In addition, a control bus maintains control of the bi directional Data Bus and provides access for control signals between the MPU and all external logic.

The MPU I/O bus relegates control to the programmed I/O devices, provides memory mapped I/O addressing and uses memory and register instructions to control all I/O operations. The MPU bus configuration is shown in Figure 3.

Programmed I/O Devices — The MPU relegates most of the I/O control to such I/O interfaces as the PIA or ACIA. Each of these circuits is programmable and can interface with peripheral devices without directly involving the MPU. For example, the MPU can preprogram a PIA to either output data to the MPU or to receive it. Thereafter, the PIA circuits assume all functions of interfacing with the peripherals and the MPU never has to look at the interface until service is required. It must service interrupts from the PIA, but never needs to wait for input data to become available or for output data to be accepted.

MEMORY MAPPED I/O Addressing — The I/O interfaces and memory are both located in the same address space within the S6800 system. The MPU can access any I/O device the same as a memory location

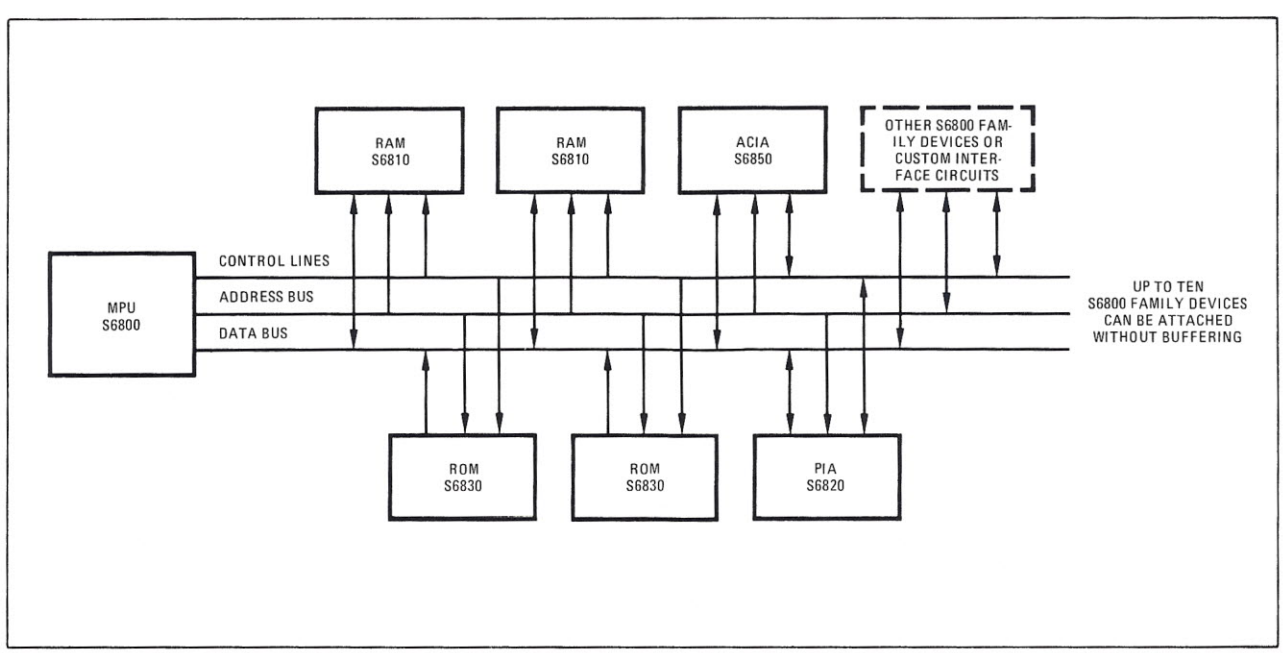


FIGURE 3. S6800 BUS SYSTEM

— with address lines, instead of separate I/O control lines. Therefore, it can manipulate data in the I/O interface registers with the same programmed instructions as it uses for memory locations. This adds flexibility and increases system efficiency.

No Special I/O Instructions — The S6800 Instruction Set complements the above I/O addressing capability with specific instructions that can be used to access memory as well as I/O circuit registers and perform directly various manipulations on the data.

BUS INTERFACE — The bus interface consists of the Data Bus (DO-D7), the Address Bus (A0-A15), Read/Write (R/W), and Valid Memory Address (VMA). There are other signals which further control the operation of the MPU and thus affect the bus without actually being properly part of the bus interface; these include Data Bus Enable (DBE), Three-State Control (TSC), Halt and the interrupt control signals IRQ and NMI.

DATA BUS — The Data Bus comprises eight bidirectional data lines, which connect the MPU, all of the memory, and any I/O devices which may be addressed by the MPU. The MPU normally controls this bus during Ø2 time for the transfer of instructions and data into the MPU and the transfer of data out of the MPU. The direction of the data on the bus is a function of the R/W line generated by the MPU; a high on R/W constitutes a read, and the MPU accepts data during the latter portion of Ø2; a low on the R/W line is defined as a write out of the MPU, and the MPU drives the bus with the write data shortly after the low-to-high transition of DBE. Control of the Data Bus may be preempted from the MPU for Direct Memory Access (DMA) operations during Ø2 by operating the Halt line (Bus Available will go high when the bus is available for other than MPU-controlled use), or during Ø1 while DBE is low, and the MPU is not concerned with the contents of the data bus. When the MPU is not driving the data bus in a write operation, these lines are placed in a high impedance state to minimize the interference with other devices driving the bus; similarly when a memory or I/O device is not driving the bus in a read operation for which that device is selected, the bus lines in that device are placed in a high impedance state. At any one time only one device should be driving the bus, with all other connected system components in the high impedance state.

Address Bus — The Address bus comprises 16 address lines, by which the MPU identifies which of the 65,536 possible memory locations is to be read out or written into. In normal operation the MPU sets an address on the bus during Ø1 while TSC is low; this remains stable throughout Ø2 for the memory access operation. For DMA and other circumstances in which it is desired to control the Address Bus apart from the MPU, Ø1 may be extended during which time TSC may be set high; the MPU will respond by taking the Address Bus and R/W outputs to the high impedance state and outputting a low on VMA. A high on TSC also forces BA low.

The Valid Memory Address (VMA) output from the MPU should always be used in conjunction with the address on the Address Bus to determine whether the MPU is actually accessing memory (or peripheral registers), since in some circumstances the MPU will issue

Save on new and reconditioned terminals.

We offer brand new data terminals at lowest prices. And the best deals you'll find on reconditioned terminals. All come with warranty.
Here are just a few examples of some good buys.

New		Reconditioned	
LSI ADM-3	$975	TI 725	$895
TI 743 KSR	$1,195	Beehive III AE	$999
TI 745	$1,875	Techtran 4100 Datacassette	$600
DECwriter II	$1,550	Couplers	$150 up

Order by phone today. Call (415) 632-2856. We accept BankAmericard and Master Charge.

NTC National Terminal Corporation

Oakland Airport Office Center, 303 Hegenberger Road, Suite 203, P.O. Box 6579, Oakland, CA 94621

CIRCLE INQUIRY NO. 19

ALTAIR 8800 OWNERS

* Does your Altair crash when the lights dim?
* Is your Altair power supply inadequate for all the memory and I/O that you'd like to run?

Then you need the unique **Parasitic Engineering** Constant-Voltage Power Supply Kit. A custom engineered power supply that installs easily in your Altair 8800 or 8800a mainframe. It has performance no other Altair power supply can match.

* Full 12 amp output with line voltage as low as 90 volts or as high as 140 volts.
* Isolation from power line fluctuations and noise.
* Protected against overloads.

Don't let power supply problems sabotage your Altair. Order your kit **TODAY.**

master charge

only $90 postpaid in the USA.
Ca residents add $5.40 sales tax.

PARASITIC ENGINEERING

PO BOX 6314 ALBANY CA 94706

CIRCLE INQUIRY NO. 20

a temporary address in a read or write cycle which might be interpreted as a "false read" or a "false write" to some memory location. VMA may be thought of as a 17th bit of address, where only half of the addressable memory (i.e. the VMA bit = 1) is usable, although occasionally the MPU will attempt to read or write some location in the other half (i.e. VMA = 0). Thus it can be combined with the higher order address bits to select or deselect memory and peripherals, as required by the MPU at that time.

Bus Control Signals — If the VMA signal is not used to deselect memory and I/O registers (PIAs and ACIAs), false reads or false writes may result in ambiguous operation. These are of particular concern in the case of RAM memories and the I/O devices register (PIAs and ACIAs), since in the case of the ROM any false reads are ignored by the MPU and have no other effect, and false writes have no effect on the ROM. In the case of the RAM a false read also is of no concern, but if TSC or Halt is used or the MPU executes a WAI instruction the R/W line floats in the high impedance state which could be interpreted as a write by the RAM; the TST instruction actually results in a false write, but the data and address are the same as an immediately previous read, so the contents of RAM are not thus altered. For PIAs and ACIAs the VMA signal must be used in the selection logic, since a read from a PIA or ACIA register is used to clear an interrupt condition, and the failure to disable false reads could result in a missing interrupt. In the case of the PIA, VMA should not be used in the form of VMA-Ø2 for the Enable (E) input, since at least one E pulse is required before each active transition of the CA1 (or CB1, etc.) to detect the interrupt; a WAI instruction depending on this transition may thus lock out interrupts by setting VMA low. It is better to apply VMA to one of the Chip Select inputs to the PIA (CS0, CS1, or inverted to $\overline{CS2}$), or to specify the design to preclude the requirement that interrupts be detected on the trailing edge of a pulse.

Read/Write (R/W) is a control signal generated by the MPU to define the direction of the Data Bus. When low, the MPU is driving the Data Bus, and the selected memory or peripheral should accept the data written into it; when R/W is high, the selected memory or peripheral is being read into the MPU, and should be driving the bus. This control goes into the high impedance state when the Address Bus is disabled by TSC.

R/W is routed to the various memory and peripheral components as part of the system control. ROMs should be disabled when R/W is low, since they cannot be written into. RAMs and PIAs use the R/W signal to distinguish read and write operations. The ACIA has four internal registers, of which two are selected in the read operation, and two are selected for write operations, by the connection of R/W to the appropriate ACIA input.

MPU Operating Cycle

Instructions are executed within the MPU in incremental time periods (MPU cycles), each consisting of one Ø1 clock period and one Ø2 clock period. When the MPU is operating on a 1 MHz input clock, each MPU cycle is 1 microsecond long. It takes a minimum of two MPU cycles or 2 microseconds to execute a single word instruction.

During the Ø1 period the MPU typically outputs a memory address to access (fetch) one 8-bit program instruction or data byte and then, during Ø2, loads the byte into an internal register. During the next Ø1 period the MPU executes the associated internal operation with the ALU and the registers. With this fetch-execute sequence an instruction may be completed in only two MPU cycles, or may require as many as 12. While the MPU is executing successive cycles, it is also common for it to overlap functions. For example, during any given clock period the MPU may be executing one instruction in the ALU or registers; while at the same time a fetch is being performed with the address in the program counter.

Program Control

These internal operations of the MPU, as well as the output of address, data, and control signals, are all managed by the instruction decode and control logic. For example, to perform the execute part of any instruction, the control logic circuits generate signals that cause the ALU to perform addition, subtraction, or some Boolean logic function. These signals can also cause the contents of one register to be transferred into another, a register to be simply incremented or decremented, or some other similar function to occur. Such ALU and register operations are used to execute all of the S6800 instructions.

MPU Addressing Modes

The S6800 eight-bit microprocessing unit has seven address modes that can be used by a programmer, with the addressing mode a function of both the type of instruction and the coding within the instruction. During the fetch part of any MPU cycle a memory address is required in order to access a particular location in the external memory. This address is normally stored in the program counter. The program counter is 16 bits wide and therefore, can address any one of a maximum of 65,536 bytes.

At the beginning of a program sequence the MPU is initialized and the beginning address is loaded into the program counter. From there on the program counter is incremented automatically, so that at the end of any instruction cycle it stores the next instruction address. If the program contains an instruction to branch or jump to a different memory location, the op code must be followed by two bytes which load the new address into the program counter. There are, however, addressing techniques with which the jump can be accomplished by fetching only one new address byte out of the memory. For example, if the destination of a branch is within 129 locations forward of 125 locations back of the current program counter contents, Relative Addressing can be used. In this mode only the op code and one signed 8-bit byte is fetched from the memory and is added to the program counter contents.

In Indexed Addressing, a single byte is added to the contents of the index register and the result is transferred into the program counter. Thus, the above addressing variations can be used to reduce the number of bytes that need be fetched to generate a new address. This reduces the number of MPU cycles and

THE LOGICAL CHOICE: Third in a series

SYMMETRICAL AND UNSYMMETRICAL PULSES 0.5Hz-5MHz.

CONTINUOUS, MANUAL ONE-SHOT & EXTERNAL TRIGGER OPERATION
External triggering to 10MHz

INDEPENDENTLY-CONTROLLABLE PULSE WIDTH & SPACING
100 nanosec-1 sec in 7 overlapping ranges 10^7:1 duty cycle range



INDEPENDENT CMOS AND TTL OUTPUTS Fan-out to 40 TTL loads

SYNCHRONOUS OUTPUT GATING

100mV-10V POSITIVE OUTPUT Less than 30 nanosec rise/fall times

CSC'S DESIGN-MATE™ 4: $124.95. NO OTHER DIGITAL PULSE GENERATOR GIVES YOU SO MUCH, FOR SO LITTLE.

Sounds hard to believe... but even a brief look at Design-Mate 4's specifications proves CSC's engineers have done it again. Whatever your application—whether you're looking for precision, flexibility or just plain economy—this compact source of fast, clean digital pulses offers the performance you need... at a price that discourages procrastination.

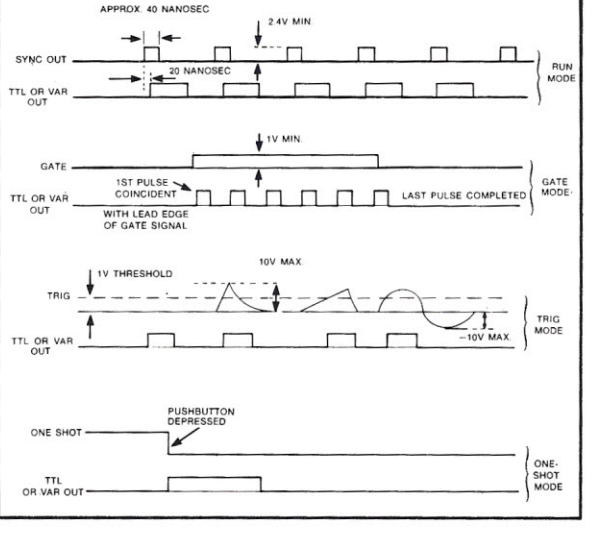
Use it as a clock source, delayed pulse generator, synchronous clock, manual system stepper, pulse stretcher, clock burst generator or in dozens of other applications. Use it alone or in tandem with other DM-4's for gated control. The wide range of controls and multiple outputs give you enormous versatility... plus compatibility with all major logic families, for research, design, development, quality control, production testing, maintenance, troubleshooting... you name it.

Now, read the specs that follow... and check the price again. Or better yet, try DM-4 for yourself at your local CSC distributor. Once you do, we think you'll find it's as hard to do without as it is easy to own.

For more information about CSC's other fine products, and a list of distributors, please call or write.

DM-4 SPECIFICATIONS

Frequency Range:	0.5 Hz to 5 MHz
Pulse Width and Spacing Controls:	100 nanosec to 1 sec. in 7 overlapping decade ranges. A single-turn vernier control provides continuous adjustment between ranges.
Duty Cycle:	10^7-to 1 Range: adjustable over entire pulse width/spacing range, 100 nanosec "ON" 1 sec "OFF" to 1 sec "ON" and 100 nanosec "OFF".
Operating Modes:	
RUN	0.5 Hz to 5 MHz as per width/spacing and amplitude control settings.
TRIG	DC to approx. 10 MHz.
Input requirements:	Sine waves 2 VP-P; pulses 1 V peak, >40 nanosec wide; maximum input ± 10 V. (Input Impedance: Approx. 10KΩDC coupled.)
GATE	Synchronous gating. Leading edge of gate signal turns generator "ON". Last pulse is completed, even if gate ends during pulse.
Input requirements:	Same as "TRIG" Mode.
ONE-SHOT	Pushbutton for single pulse. Output pulse occurs each time push-button is pressed.
OUTPUTS:	
VAR OUT	
Amplitude	0.1-10 V positive
Rise/fall time	Less than 30 nanosec
Impedance	400Ωmax.
TTL OUT	
Fan-out	40 TTL Loads
Sink	160 milliamps—0.8 V max.
Rise/fall time	Less than 20 nanosec
SYNC OUT	
Pulse width	Approx. 40 nanosec. Other sync pulse spec's same as TTL out.
Pulse lead time	Sync pulse leads outputs by approx. 20 nanosec.
POWER	117 VAC ± 10%, 50/60 Hz, 5 watts (220 VAC, 50/60 Hz also available, at slightly higher cost.)
SIZE (WxLxH)	7.5 x 6.5 x 3.25" 191 x 165 x 83 mm
WEIGHT	2 lbs. (0.91 Kg)



CONTINENTAL SPECIALTIES CORPORATION

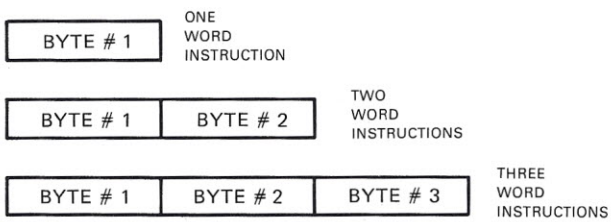
44 Kendall Street, Box 1942 New Haven, CT 06509 • 203-624-3103 TWX: 710-465-1227
West Coast office: Box 7809, San Francisco, CA 94119 • 415-421-8872 TWX: 910-372-7992
Canada: Len Finkler Ltd., Ontario

CIRCLE INQUIRY NO. 21

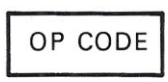
speeds up program execution.

The various addressing modes can also be used in a similar manner to generate the source or destination addresses for data. MPU addressing modes are summarized in the following;

INSTRUCTION FORMAT

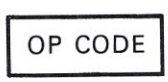


ACCUMULATOR ADDRESSING (ACCX)



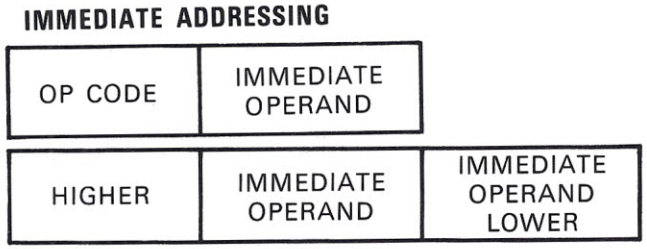
A single byte instruction addressing operands only in accumulator A or accumulator B.

IMPLIED ADDRESSING



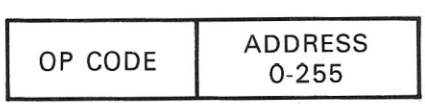
Single byte instruction where the operand address is implied by the instruction definition (i.e., Stack Pointer, Index Register or Condition Register).

IMMEDIATE ADDRESSING



Two or three byte instructions with an eight or sixteen bit operand respectively. For accumulator operations the eight bit operand is contained in the second byte of a two byte instruction. For Index Register operations (e.g. LDX) sixteen bit operand is contained in the second and third byte of a three byte instruction.

DIRECT ADDRESSING



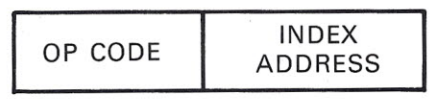
Two byte instructions with the address of the operand contained in the second byte of the instruction. This format allows direct addressing of operands within the first 256 memory locations.

EXTENDED ADDRESSING



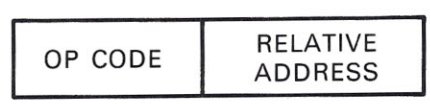
Three byte instructions with the higher eight bits of the operand address contained in the second byte and the lower eight bits of address contained in the third byte of the instruction. This format allows direct addressing of all 65,536 memory locations.

INDEXED ADDRESSING



Two byte instructions where the 8 bit unsigned address contained in the second byte of the instruction is added to the sixteen bit Index Register resulting in a sixteen bit effective address. The effective address is stored in a temporary register and the contents of the Index Register are unchanged.

RELATIVE ADDRESSING



Two byte instructions where the relative address contained in the second byte of the instruction is added to the sixteen bit program counter plus two. The relative address is interpreted as a two's complement number allowing relative addressing within a range of −125 to +129 bytes of the present instruction.

Interrupts.

The S6800 MPU can be interrupted by any of several signals and program instructions, each of which initiates a different sequence in the MPU. Including the Reset signal, there are four interrupts — three hardware interrupts (signal lines connected to the MPU) and one software interrupt (SWI instruction). Each class of interrupt is described in the follow ing;

Nonmaskable Interrupt (NMI) — initiated by a low-going signal on the $\overline{\text{NMI}}$ line to the MPU; always interrupts the MPU — even while another interrupt is being processed and the interrupt mask bit is set. Therefore, NMI can be considered to the highest priority interrupt. It causes the following sequence of events:

1. At the completion of the instruction being executed, the contents of the program accessible registers (Figure 3) are stored in the stack.
2. The interrupt mask bit is set.
3. Starting with its next cycle, the MPU accesses locations FFFC and FFFD in the memory and loads the contents into the program counter.

The POLY 88 Microcomputer System

If you are into computers or considering a system, the POLY 88 is the machine to contemplate.

HARDWARE

• Popular 8080 central processor • Single-board CPU with ROM, RAM, vectored interrupt, real time clock, single-step logic and serial I/O • Video interface card – generates video to TV monitor and provides parallel keyboard input port • Serial and cassette mini-cards plug directly into CPU with ribbon cables • Cassette • ROM monitor with powerful debugger, video software, bootstrap loader • Backplane and power supply on one board simplifies construction • Rugged 6 amp power supply • All circuit boards are high quality, double-sided with plated-through holes • System is compatible with a wide range of Altair peripherals • Minimum point to point wiring means that the POLY 88 kit can go together in three evenings!

ABOUT SOFTWARE

Software is the reason the POLY 88 was designed. The operator can proceed from higher level languages like BASIC to developing machine code with the aid of our assembler. Our BASIC is a full 8K BASIC with character and byte manipulation. Best of all, the programmer is finally free of the teletype emulation mode so the video display can be used to full advantage.

The video display provides a unique opportunity to write new types of programs and games. Characters (16 lines of 64) and graphics (48 by 128 grid) are part of the processor's memory, so the display may be altered rapidly — the entire screen written in less than 20 milliseconds.

POLY 88 hardware provides many additional features that programmers have come to expect, such as vectored interrupt and real time clock.

See it at your local computer store.

CIRCLE INQUIRY NO. 22

ARE YOU NEW TO COMPUTERS?

The POLY 88 was designed for ease of use. No one should have to learn all the inner workings of computers just to enjoy one at a reasonable price. With the POLY 88, you can "play" pre-developed programs or explore the world of computer languages as your interests expand.

THE POLY 88 IS FOR EVERYONE

Want to develop a new computer language? Want to fight Klingons? The POLY 88 provides a firm foundation upon which to build your interests and develop your skills.

POLY 88 SYSTEM PRICES:

SYSTEM 1 — Kit includes 8080 vectored interrupt processor with real time clock, ½ K of RAM and 1K monitor on ROM: Video Terminal Interface displays 16 lines of 32 characters on a video screen and has a keyboard input port; cabinet, backplane, and power supply; complete assembly, operation and theory manual. $595.

SYSTEM 2 — System 1 plus 64 character line option and Byte/biphase cassette interface kit. $690.

SYSTEM 3 — System 2 plus 8K of RAM with BASIC and assembler programs on cassette tape. $990.

SYSTEM 4 — The complete kit. It includes system 3 *and* TV monitor, keyboard and cassette recorder with all necessary cables and connectors. $1350.

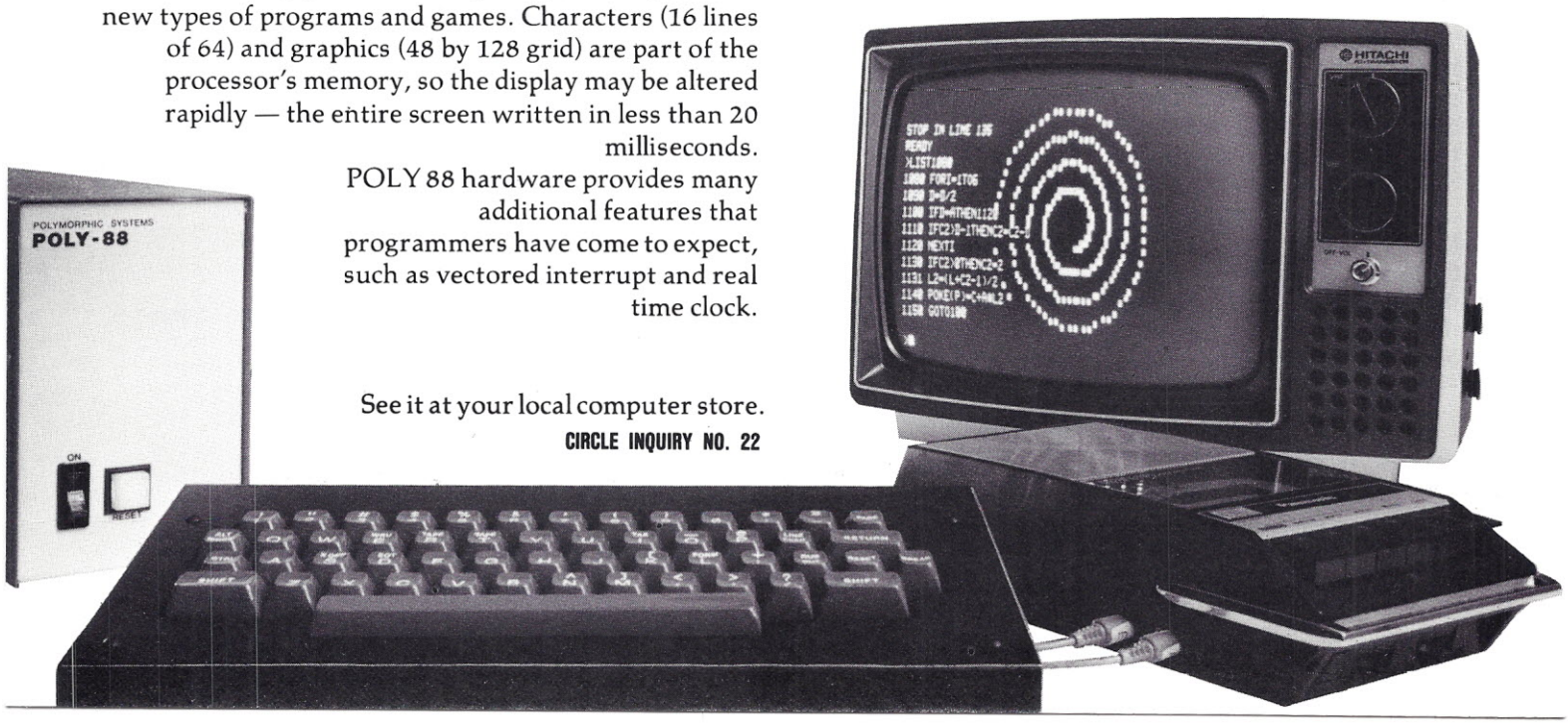
SYSTEM 7 — System 4 assembled, tested and ready to run. $1750.

ACCESSORIES — 8K RAM kit, $300. Assembled $385
POLY I/O Ideaboard, hardware prototyping kit board. $55.
Analog Interface (1 channel) kit. $145.

Prices effective until January 15, 1976. Prepaid orders shipped postpaid.

PolyMorphic Systems

737 S. Kellogg, Goleta, CA 93017
(805) 967-2351



Interrupt Request (IRQ) — initiated by a logic low signal on the $\overline{IRQ}$ line; interrupts the MPU as long as the interrupt mask bit is not set. It causes the following sequence of events:

1. At the completion of the instruction being executed, the interrupt mask bit is tested. If the bit is set the interrupt must wait; if it is not set, contents of the program accessible registers are stored in the stack.
2. The interrupt mask bit is set.
3. Starting with the next cycle, the MPU accesses locations FFFA and FFFB in the memory and loads the contents into the program counter.

Software Interrupt (SWI) — initiated by the SWI instruction and causes the following sequence of events:

1. Contents of the program accessible registers are stored in the stack.
2. The interrupt mask bit is set.
3. Starting with the next cycle, the MPU accesses locations FFFE and FFFF in the memory and loads the contents into the program counter.

Reset — initiated by a positive going edge on the RESET line to the MPU. It causes the following sequence of events:

1. All program accessible registers are cleared and other circuits in the MPU are initialized.
2. The interrupt mask bit is set.
3. Starting with the next cycle, the MPU accesses locations FFFE and FFFF in the memory and loads the contents into the program counter.

Wait (WAI) — an instruction that causes the MPU to stop all processing and wait for a hardware interrupt. This instruction is not an interrupt in itself because it does not cause branching to any memory address, however, it does cause contents of the program accessible registers to be stored into the stack, in preparation for an interrupt.

All interrupts are vectored — they cause the MPU to automatically access a predetermined location in the memory and fetch a branch address of the routine or program to which the MPU is to go to service the interrupt. All interrupts except Reset also cause the contents of each program accessible MPU register (with the exception of the stack pointer) to be transferred to the external stack and thus be saved for later processing. The IRQ interrupt is also maskable — it cannot interrupt the MPU as long as bit 4 in the condition code register is set.

The S6800 requires a 16-bit vector address to indicate the location of routines for Restart, Non-maskable Interrupt, and Maskable Interrupt. Additionally an address is required for the Software Interrupt Instruction (SWI). The processor assumes the uppermost eight memory locations, FFF8 — FFFF, are assigned as interrupt vector addresses as defined in Figure 4.

FIGURE 4. MEMORY MAP FOR INTERRUPT VECTORS

Vector MS	Vector LS	Description
FFFE	FFFF	Restart
FFFC	FFFD	Non-maskable Interrupt
FFFA	FFFB	Software Interrupt
FFF8	FFF9	Interrupt Request

After completing the current instruction execution the processor checks for an allowable interrupt request via the $\overline{IRQ}$ or $\overline{NMI}$ inputs as shown by the simplified flow chart in Figure 5.

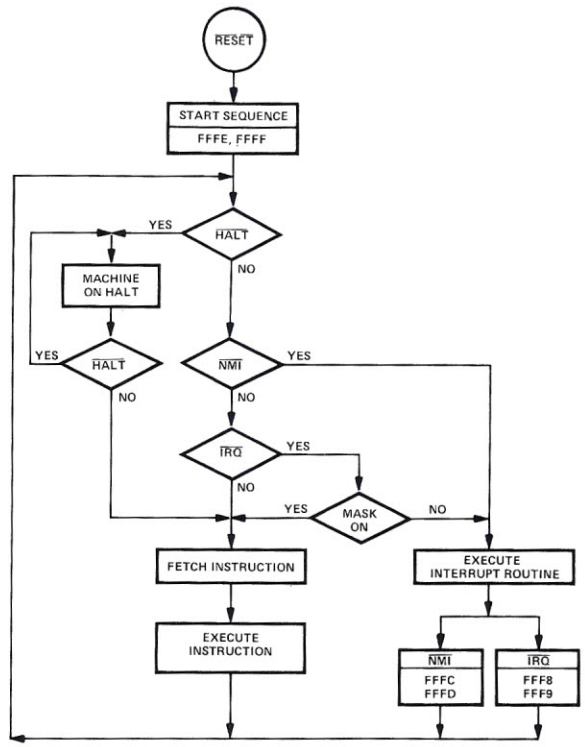
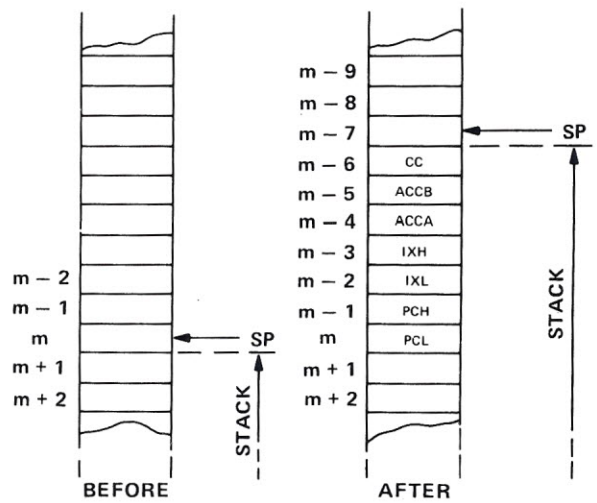


FIGURE 5. MPU FLOW CHART



SP = Stack Pointer
CC = Condition Codes (Also called the Processor Status Byte)
ACCB = Accumulator B
ACCA = Accumulator A
IXH = Index Register, Higher Order 8 Bits
IXL = Index Register, Lower Order 8 Bits
PCH = Program Counter, Higher Order 8 Bits
PCL = Program Counter, Lower Order 8 Bits

FIGURE 6. SAVING THE STATUS OF THE MICROPROCESSOR IN THE STACK

Recognition of either external interrupt request or a Wait for Interrupt (WAI) or Software Interrupt (SWI) instruction causes the contents of the Index Register, Program Counter, Accumulators and Condition Code Register to be transferred to the stack as shown in Figure 6.

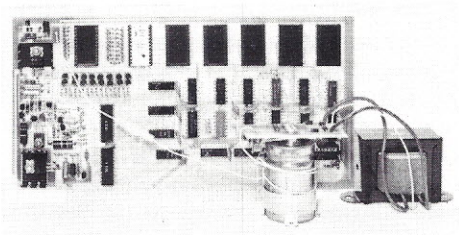
S6800 INSTRUCTION SET

The S6800 MPU has a set of 72 basic instructions, listed in alphabetical order in Table 1. These include binary and decimal arithmetic functions, as well as logical, shift, rotate, load, store, branch, interrupt, and stack manipulation functions. Most of the instructions have several variations and most can be used with several memory addressing modes. Thus, the total complex of instructions available to the programmer actually is 197.

An instruction can be from one to three bytes long, depending on the addressing mode used with the instruction. The first byte always contains the operation code, which designates the kind of operation the MPU will perform. In single byte instructions no memory address is required, because the operation is performed on one of the internal MPU registers. In multiple byte instructions the second and third byte can be the operand, or a memory address for the operand.

A noteworthy feature of the S6800 MPU is that some of the instructions can operate directly on any memory location. In other computer systems it is common that the processor fetches an operand from memory, stores it in the accumulator, then executes

PRAMMER *by Xybek*



★ **1792 bytes of 1702A EPROM, 256 bytes of RAM, and a PROM programmer,** all on one board. The programmer is not an I/O device. At the flick of a switch, one of the 1702A positions becomes a programming address. With programming enabled, storing into this address space will program the PROM. With programming disabled, that address space is just ordinary read-only memory.

★ Because PRAMMER contains its own clock and microprogram for read-write control, it will, through the S-100 bus, interface with *any* CPU.

★ The kit comes complete with one 1702A containing stand-alone software for programming other 1702A's, and a complete listing of an eleven-function development system which fits into the 1792 bytes of PROM space.

COMPLETE KIT: *Introductory Price*. **.$189**

Master Charge and BankAmericard accepted.
California residents please add sales tax.

XYBEK • P.O. Box 1631 • Cupertino, CA 95014

CIRCLE INQUIRY NO. 23

ABA	Add Accumulators
ADC	Add with Carry
ADD	Add
AND	Logical And
ASL	Arithmetic Shift Left
ASR	Arithmetic Shift Right
BCC	Branch if Carry Clear
BCS	Branch if Carry Set
BEQ	Branch if Equal to Zero
BGE	Branch if Greater or Equal Zero
BGT	Branch if Greater than Zero
BHI	Branch if Higher
BIT	Bit Test
BLE	Branch if Less or Equal
BLS	Branch if Lower or Same
BLT	Branch if Less than Zero
BMI	Branch if Minus
BNE	Branch if Not Equal to Zero
BPL	Branch if Plus
BRA	Branch Always
BSR	Branch to Subroutine
BVC	Branch if Overflow Clear
BVS	Branch if Overflow Set
CBA	Compare Accumulators
CLC	Clear Carry
CLI	Clear Interrupt Mask
CLR	Clear
CLV	Clear Overflow
CMP	Compare
COM	Complement
CPX	Compare Index Register
DAA	Decimal Adjust
DEC	Decrement
DES	Decrement Stack Pointer
DEX	Decrement Index Register
FOR	Exclusive OR
INC	Increment
INS	Increment Stack Pointer
INX	Increment Index Register
JMP	Jump
JSR	Jump to Subroutine
LDA	Load Accumulator
LDS	Load Stack Pointer
LDX	Load Index Register
LSR	Logical Shift Right
NEG	Nagate
NOP	No Operation
ORA	Inclusive OR Accumulator
PSH	Push Data
PUL	Pull Data
ROL	Rotate Left
ROR	Rotate Right
RTI	Return from Interrupt
RTS	Return from Subroutine
SBA	Subtract Accumulators
SBC	Subtract with Carry
SEC	Set Carry
SEI	Set Interrupt Mask
SEV	Set Overflow
STA	Store Accumulator
STS	Store Stack Register
STX	Store Index Register
SUB	Subtract
SWI	Software Interrupt
TAB	Transfer Accumulators
TAP	Transfer Accumulators to Condition Code Reg.
TBA	Transfer Accumulators
TPA	Transfer Condition Code Reg. to Accumulator
TST	Test
TSX	Transfer Stack Pointer to Index Register
TXS	Transfer Index Register to Stack Pointer
WAI	Wait for Interrupt

TABLE 1. S6800 MICROPROCESSOR INSTRUCTION SET

the operation in the ALU, and finally writes the result back into the memory. The S6800 is able to accomplish the same with only a single instruction, because it operates with any external location in the same manner as with an internal register. For example, it can directly increment or decrement the contents of a memory location. Because the MPU addresses I/O devices just like a memory location, it can do the same with registers inside the PIA or ACIA. The ASL, ASR, LSR, and ROL are other examples of instructions which operate in this manner.

S6810 — 128 X 8 STATIC READ/WRITE MEMORY

FUNCTIONAL DESCRIPTION

The S6810 is a static 128 X 8 Read/Write Memory designed and organized to be compatible with the S6800 Microprocessor. Interfacing to the S6810 consists of an 8 Bit Bidirectional Data Bus, Seven Address Lines, a single Read/Write Control line, and six Chip Enable lines, four negative and two positive.

For ease of use, the S6810 is a totally static memory requiring no clocks or cell refresh. The S6810 is fabricated with N channel silicon gate technology to be fully DTL/TTL compatible with only a single +5 volt power supply required.See Figure 7 for Funtional Block Diagram.

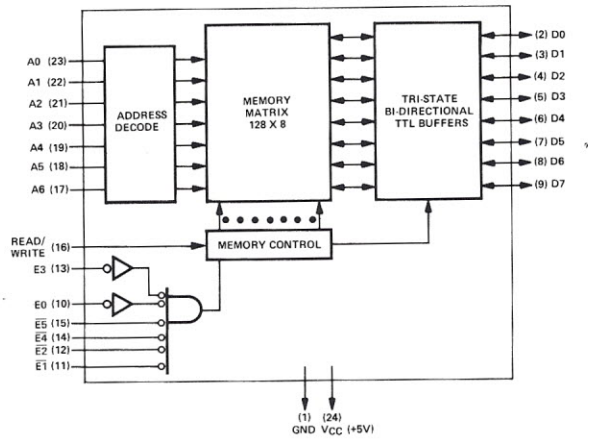


FIGURE 7. FUNCTIONAL BLOCK DIAGRAM

FEATURES

- Organized as 128 Bytes of 8 Bits
- Static Operation
- Bi-Directional Three-State Data Input/Output
- Six Chip Enable Inputs (Four Active Low, Two Active High)
- Single 5-Volt Power Supply
- TTL Compatible
- Maximum Access Time = 1.0μs for S6810
 575 ns for S6810-1

S6820 — PERIPHERAL INTERFACE ADAPTER (PIA)

FUNCTIONAL DESCRIPTION

The S6820 Peripheral Interface Adapter provides the universal means of interfacing peripheral equiment to the S6800 Microprocessing Unit (MPU). This device is capable of interfacing the MPU to peripherals through two I/O 8-bit bidirectional peripheral data buses and four control lines. No external logic is required for interfacing to most peripheral devices.

The functional configuration of the PIA is programmed by the MPU during system initialization. Each of the peripheral data lines can be programmed to act as an input or output, and each of the four control/interrupt request lines may be programmed for one of several control modes. This allows a high degree of flexibility in the over-all operation of the interface.

The PIA interfaces to the S6800 MPU with an eight-bit bidirectional data bus, three chip select lines, two register select lines, two interrupt request lines, read/write line, enable line and reset line. These signals, in conjunction with the S6800 VMA output, permit the MPU to have complete control over the PIA. VMA may be utilized to gate the input signals to the PIA. See Figure 8 for Funtional Block Diagram.

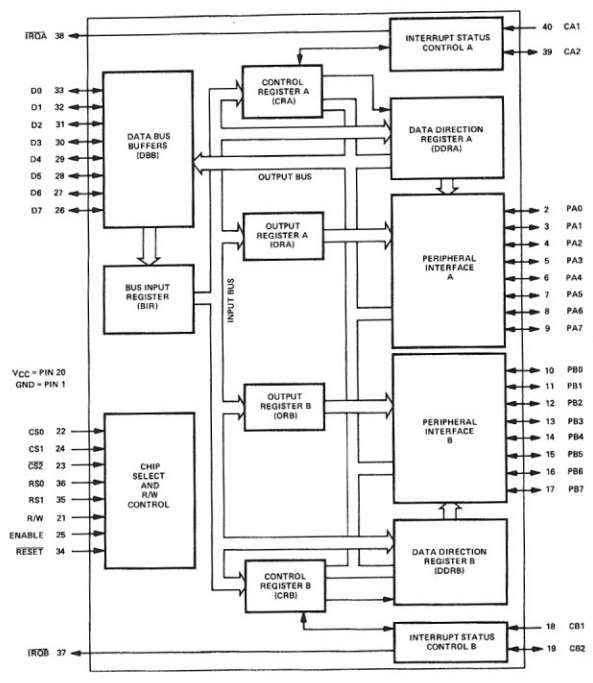


FIGURE 8. FUNCTIONAL BLOCK DIAGRAM

FEATURES

- 8-Bit Bidirectional Data Bus for Communication with the MPU
- Two Bidirectional 8-Bit Buses for Interface to Peripherals
- Two Programmable Control Registers
- Two Programmable Data Direction Registers
- Four Individually-Controlled Interrupt Input Lines; Two Usable as Peripheral Control Outputs
- Handshake Control Logic for Input and Output Peripheral Operation
- High-Impedance 3-State and Direct Transistor Drive Peripheral Lines
- Program Controlled Interrupt and Interrupt Disable Capability

S6830 — 1024 X 8 READ ONLY MEMORY

FUNCTIONAL DESCRIPTION

The S6830 is a mask programmable read only memory organized 1024 words x 8 bits for application in byte organized systems. The S6830 is totally bus compatible with the S6800 microprocessor. Interfacing to the S6830 consists of an 8 bit three-state data bus, four mask programmable chip selects and ten address lines.

The S6830 is a totally static memory requiring no clocks. Access time is compatible with maximum data rates in a S6800 microprocessor system. The device operates from a single +5 volt power supply and is fabricated with N channel silicon gate technology. See Figure 9 for Function Block Diagram.

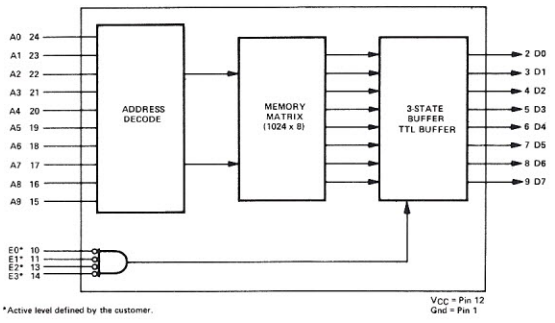


FIGURE 9. FUNCTIONAL BLOCK DIAGRAM

FEATURES

- Organized as 1024-Bytes of 8 Bits
- Static Operation
- Three-State Data Output
- Four Chip Enable Inputs (Mask Programmable)
- Single 5-Volt Power Supply
- TTL Compatible Input/Output
- Maximum Access Time = 575 ns

S6831/A/B/C — 2048 X 8 READ ONLY MEMORY

FUNCTIONAL DESCRIPTION

The S6831/A/B/C is a 16,384 bit mask programmable MOS Read Only Memory organized 2K words x 8 bits. This ROM has been designed to supply large bit storage, high performance memory for microprocessors and other demanding applications with simple interface requirements. The device will operate from a single +5V supply and is manufactured with a N-channel silicon gate depletion load technology. This device is available in all common high density ROM pinouts. See Figure 10 for Functional Block Diagram.

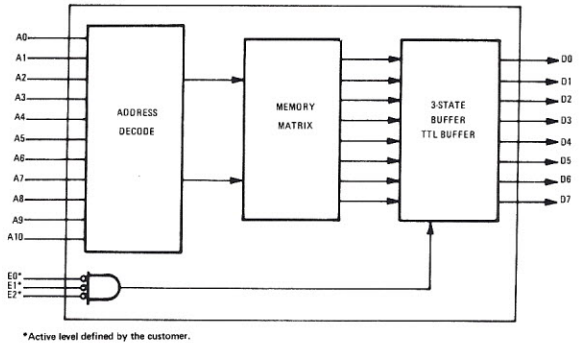


FIGURE 10. FUNCTIONAL BLOCK DIAGRAM

ALTAIR 8800 OWNERS

Is your ALTAIR:

* Slow to start up . . .
* Writing all 0's or 1's into memory . . .
* Producing the wrong STATUS . . .
* Having troubles running BASIC . . .

Then your Altair may have CPU Clock problems.

PARASITIC ENGINEERING now offers an improved fix-kit for the Altair 8800 CPU Clock; for only $15.

Send now for our FREE brochure detailing what this kit can do for your ALTAIR. Better yet, see for yourself. Send for your kit TODAY.

ONLY $15.

master charge

Kit is shipped postpaid anywhere in the United States. Kit includes complete instructions and all parts necessary to get 'Cookbook Clock Pulses.'

PARASITIC ENGINEERING

PO BOX 6314 **ALBANY CA 94706**

CIRCLE INQUIRY NO. 24

FEATURES

- Mask programmable
- Maximum Access Time = 450 ns@C_L = 130 pF
- Low Power 150 mW avg.
- Organized as 2048-Bytes of 8 Bits
- Static Operation
- Three-State Data Output
- 3 Chip Enable Inputs (Mask Programmable)
- The S6831 is pinout similar with the S6830
- The S6831A is pinout compatible with the 2316A, 8316A
- The S6831B is pinout compatible with the Intel 2316B, MC68317
- The S6831C is pinout compatible with the EA4600
- Single 5-Volt Power Supply
- TTL Compatible Input/Output

S6834 — 512 X 8 BIT EPROM

FUNCTIONAL DESCRIPTION

The S6834 is a high speed, static, 512 x 8 bit, erasable and electrically programmable read only memory designed for the in bus-organized systems. Both input and output are TTL compatable during both read and write modes. Packaged in a 24 pin hermetically sealed dual in-line package the bit pattern can be erased by exposing the chip to an ultra-violet light source through the transparent lid, after which a new pattern can be written. See Figure 11 for Funtional Block Diagram.

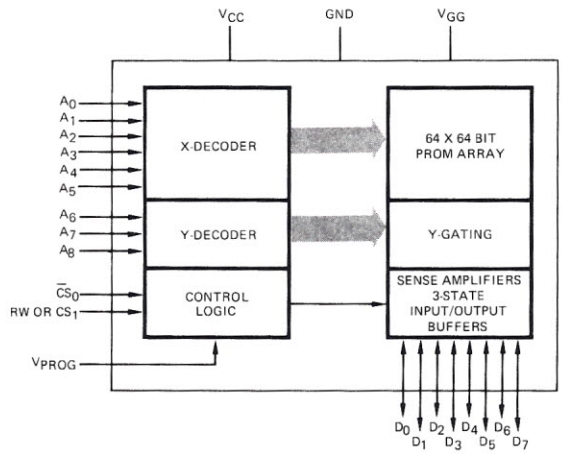


FIGURE 11. FUNCTIONAL BLOCK DIAGRAM

FEATURES

- On-Board Programmability
- Fast Access Time — 575 ms Max.
- Pin Configuration Similar to the S6830 1K x 8 Bit ROM
- High Speed Programming — Less than 1 Minute for all 4096 Bits
- Programmed with R/W, CS and VPROG Pins
- Completely TTL Compatible — Excluding the VPROG Pin
- Ultraviolet Light Erasable — Less than 10 Minutes
- Static Operation — No Clocks Required
- Three-State Data I/O
- Standard Power Supplies +5V and −12V
- Mature P-Chan Process

S6850 — ASYNCHRONOUS COMMUNICATION INTERFACE ADAPTER (ACIA)

FUNCTIONAL DESCRIPTION

The S6850 Asynchronous Communications Interface Adapter (ACIA) provides the data formatting and control to interface serial asynchronous data communications to bus organized systems such as the S6800 Microprocessing Unit.

The S6850 includes select enable, read/write, interrupt and bus interface logic to allow data transfer over an eight bit bi-directional data bus. The parallel data of the bus system is serially transmitted and received by the asynchronous data interface, with proper formatting and error checking. The functional configuration of the ACIA is programmed via the data bus during system initialization. Word lengths, clock division ratios and transmit control through the Request to Send output may be programmed. For modem operation three control lines are provided. These lines allow the ACIA to interface directly with the S6860 0-600 bps digital modem. See Figure 12 for Functional Block Diagram.

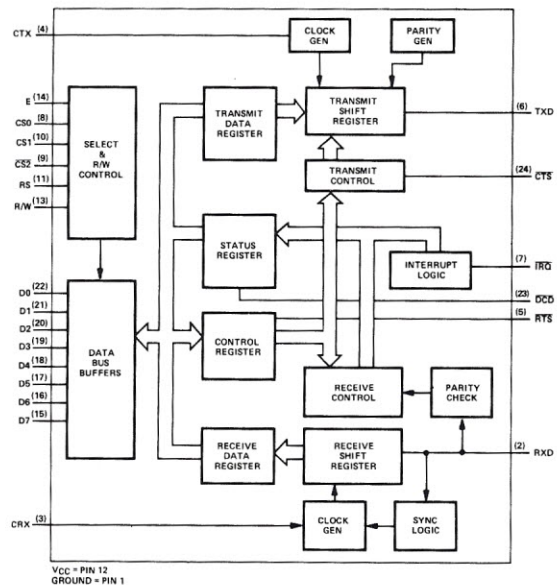


FIGURE 12. FUNCTIONAL BLOCK DIAGRAM

FEATURES

- Eight and nine-bit transmission with optional even and odd parity.
- Parity, overrun and framing error checking.

- Programmable control register.
- Optional ÷1, ÷16, and ÷64 clock modes.
- Up to 500,000 bps transmission.
- 8 Bit Bidirectional Data Bus for Communication with MPU.
- False start bit deletion.
- Peripheral/modem control functions.
- Double buffered Receiver and Transmitter.
- One or two stop bit operation.

S2350 — UNIVERSAL SYNCHRONOUS RECEIVER/TRANSMITTER (USRT)

FUNCTIONAL DESCRIPTION

The S2350 Universal Synchronous Receiver Transmitter (USRT) is a single chip MOS/LSI device that totally replaces the serial to parallel and parallel to serial conversion logic required to interface a word parallel controller or data terminal to a bit-serial, synchronous communication network.

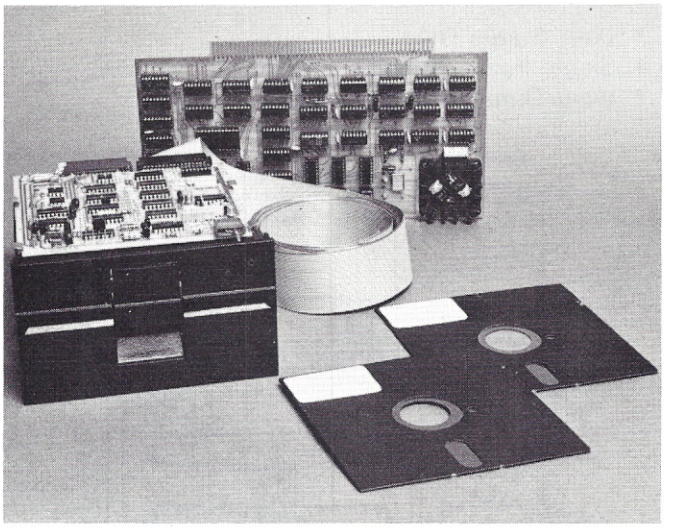
The USRT consists of separate receiver and transmitter sections with independent clocks, data lines and status. Common with the transmitter and receiver are word length and parity mode. Data is transmitted and received in a NRZ format at a rate equal to the respective input clock frequency.

Data messages are transmitted as a contiguous character stream, bit synchronous with respect to a clock and character synchronous with respect to framing or "sync" characters initializing each message. The USRT receiver compares the contents of the internal Receiver Sync Register with the incoming data stream in a bit transparent mode. When a compare is made, the receiver becomes character synchronous formatting a 5, 6, 7, or 8 bit character for output each character time. The receiver has an output buffer register allowing a full character time to transfer the data out. The receiver status outputs indicate received data available (RDA), receiver overrun (ROR), receive parity error (RPE) and sync character received (SCR). Status bits are available on individual output lines and can also be multiplexed onto the output data lines for bus organized systems. The data lines have tri-state outputs.

The USRT transmitter outputs 5, 6, 7, or 8 bit characters with correct parity at the transmitter serial output (TSO). The transmitter is buffered to allow a full character time to respond to a transmitter buffer empty (TBMT) request for data. Data is transmitted in a NRZ format changing on the positive transition of the transmitter clock (TCP). The character in the transmitter fill register is inserted into the data message if a data character is not loaded into the transmitter after a TBMT request. See Figure 13 for Functional Block Diagram.

FEATURES

- 500 KHz Data Rates
- Internal Sync Detection
- Fill Character Register
- Double Buffered Input/Output
- Bus Oriented Outputs
- 5-8 Bit Characters
- Odd/Even or No Parity



COMPLETE FLOPPY DISK SYSTEM FOR YOUR ALTAIR/IMSAI $599

That's right, complete.

The North Star MICRO-DISK SYSTEM uses the Shugart mini floppy™ disk drive. The controller is an Altair compatible PC board with on-board PROM for bootstrap load. It can control up to three drives, either with or without interrupts.

No system is complete without software: we provide the PROM bootstrap, a file-oriented disk operating system, and our powerful extended BASIC with sequential and random disk file accessing.

Each 5" diameter diskette has 90k data byte capacity. BASIC loads in less than 2 seconds. The drive itself can be mounted **inside** your computer (with specified cutout), and use your **existing** power supply (.5 amp at 5V and .9 amp at 12V typ). Or, if you prefer, we offer a power supply and enclosure.

Sound unbelievable? See the North Star MICRO-DISK SYSTEM at your local computer store. For a high-performance BASIC computing system, all you need is an 8080 or Z80 computer, 16k of memory, a terminal, and the North Star MICRO-DISK SYSTEM. For additional performance, obtain up to a factor of ten in BASIC execution speed by also ordering the North Star hardware Floating Point Board (FPB-A). Use of the FPB-A also saves about 1k of memory by eliminating software arithmetic routines.

Included: North Star controller kit (highest quality PC board and components, sockets for all IC's, and power regulation for one drive), SA-400 drive, cabling and connectors, 2 diskettes (one containing file DOS and BASIC), complete hardware and software documentation, and shipping.

MICRO-DISK SYSTEM	$599
(ASSEMBLED)	$699
ADDITIONAL DRIVES	$425 ea.
DISKETTES	$4.50 ea.
FPB-A	$359
(ASSEMBLED)	$499

To place order, send check, money order or BA card # with exp. date and signature. Uncertified checks require 6 weeks processing. California residents add sales tax.

NORTH STAR COMPUTERS, INC.
2465 Fourth Street
Berkeley, CA 94710

CIRCLE INQUIRY NO. 25

- Error Status Flags
- Single Power Supply (+5v)
- Input/Output TTL Compatible

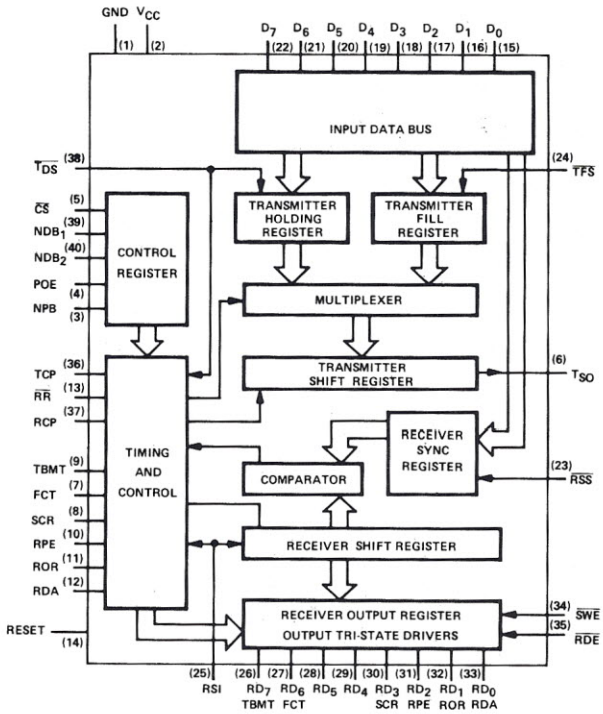


FIGURE 13. FUNCTIONAL BLOCK DIAGRAM

S6860 — 0-600 BPS DIGITAL MODEM

FUNCTIONAL DESCRIPTION

The S6860 is a 0-600 bps Digital Modem circuit designed to be integrated into a wide range of equipment utilizing serial data communications.

The modem provides the necessary modulation, demodulation and supervisory control functions to implement a serial data communications link, over a voice grade channel, utilizing frequency shift keying (FSK) a bit rates up to 600 bps. The S6860 can be implemented into a wide range of data handling systems, including stand alone modems, data storage devices, remote data communication terminals and I/O interfaces for minicomputers.

N-channel silicon gate technology permits the S6860 to operate using a single voltage supply and be fully TTL compatible.

The modem is compatible with the S6800 microcomputer family, interfacing directly with the Asynchronous Communications Interface Adapter (ACIA) to provide low-speed data communications capability. See Figure 14 for Functional Block Diagram.

FEATURES

- TTL compatible terminal interfaces
- Crystal/External reference control
- Compatible functions for 100 series data sets and 1001 A/B data couplers
- Full or half duplex operation
- Originate and answer mode
- Auto answer and disconnect
- Modem self test

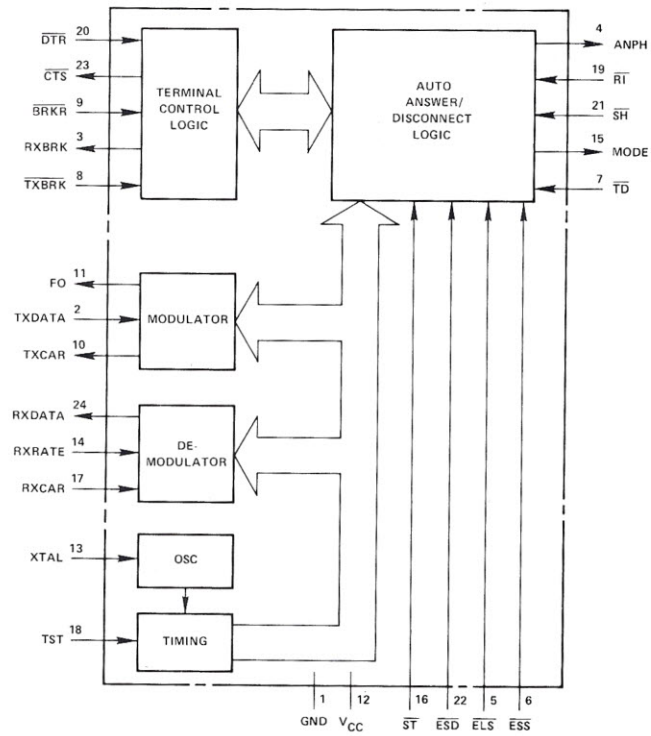


FIGURE 14. FUNCTIONAL BLOCK DIAGRAM

TYPICAL S6800 MICROCOMPUTER CONFIGURATION

The S6800 microcomputer functional IC components may be assembled in a modular building block manner into a very simple microcomputer system, or into any of progressively more complex systems, which can be used in many general or special purpose applications. The important feature of the S6800 family is that all microcomputer system components are directly compatible in signal functions, circuit performance characteristics, and logic levels. All operate on a single +5 Volt power supply.

A basic microcomputer system built with the S6800 functional components is shown in Figure 15. This basic microcomputer configuration includes a S6800 Microprocessor (MPU), IK bytes of ROM program storage, 128 bytes of RAM working storage and a two part input/output peripheral interface circuit.

Two-Phase Clock Circuitry and Timing — The MPU requires a two-phase non-overlapping clock which has a frequency range as high as 1 MHz. In addition to the two phases, this circuit should also generate an enable signal E, and its complement $\bar{E}$, to enable ROMs, RAMs, PIAs and ACIAs. This Enable signal and its complement is obtained by ANDing Ø2 and VMA (Valid Memory Address).

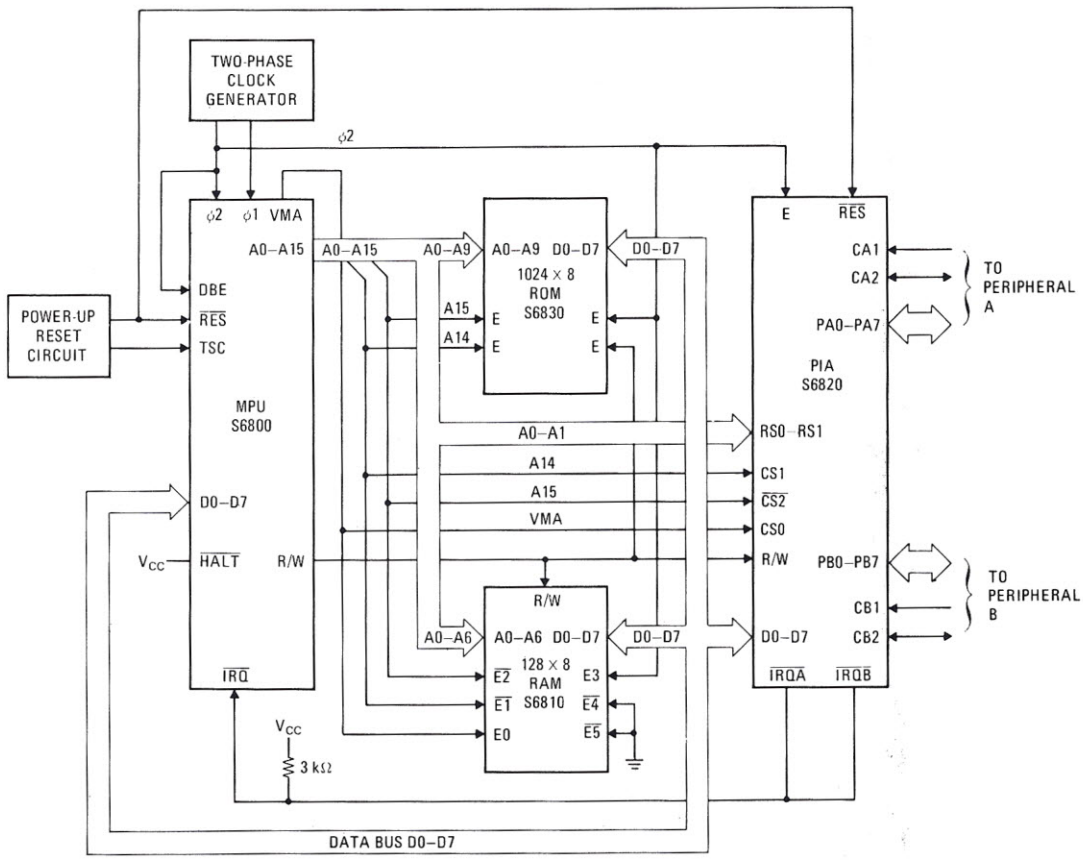


FIGURE 15. MINIMUM MICROCOMPUTER SYSTEM CONFIGURATION

YOU'LL SAY...

THANKS FOR THE MEMORY

VECTOR GRAPHIC

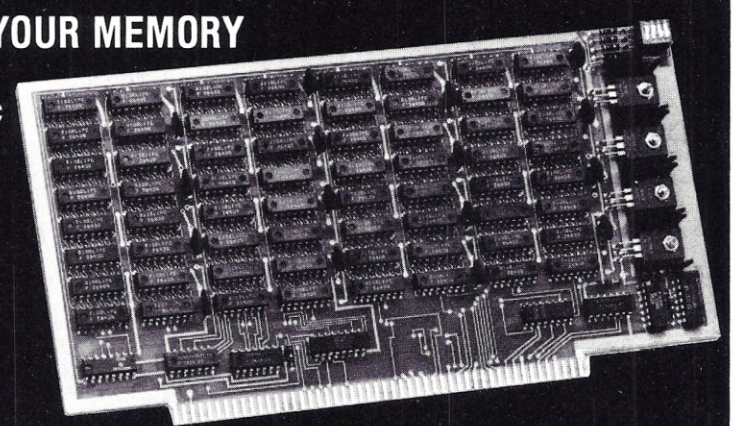
WHY OUR MEMORY SHOULD BE YOUR MEMORY

1. Quality 2. Delivery 3. Price

ALTAIR & IMSAI COMPATIBLE 8K STATIC RAM SPECIFICATIONS:

Access Time: 450 ns - no wait states
Current Requirement: +5 to +10V at 1.6A worst case, 1.35A typical
Memory Chips: Prime components *plus two extras*
Address Lines: Fully buffered
Memory Protect: Hardware 8K
Power Regulators: 4 ea. 7805
Address Select: Dip switch accessable from top of board. No need to remove board to relocate
Output Disable: Permits use with transparent loader
Board: Quality G-10 material with solder mask both sides. *Pre-tested for etch bridges.*

Order your 8K RAM kit for only $265.00 +6% Cal. sales tax +3% hndlg. $350 assmbld., both incl. sockets.



P.O. BOX 4784
THOUSAND OAKS, CA 91359
TEL:(213) 889-9809

T.M.

VECTOR GRAPHIC INC.

CIRCLE INQUIRY NO. 26

The best Hardware and Software

the ZPU™ - $269

This is the world's most powerful CPU card - and it features the most powerful micro - the Z80. (158 instructions, 696 opcodes and up to 4Mhz operation) The ZPU makes all this power available to you in a unique and versatile board. It features TWO on-board clocks including the exclusive variable frequency clock - which operates from DC to more than 4Mhz! NO CPU in the world outperforms the original - the ZPU....DELIVERY: From Stock to 21 days.

16k of RAM - $574

Super speed, super low power, super versatility - at a super price. That's what the Z16 memory is all about. It uses 4K x 1 static memory chips with 200 ns access time - and the full 16K consumes only 350ma from the +8 line and 100 ma from the +16! The Z16 may be bought as 4,8,12 or 16K units - the only difference is in the number of chips - and each 4K bank is individually adressable at any 4K border. There's much more but no room to tell! Prices range: 4K - $169; 8K - $295; 12K - $445; 4K expansion kits $140. DELIVERY:Stock to 30 days.

Monitor, I/O, Cassette - $295

The SMB (System Monitor Board) is an "everything else" complement to the ZPU or any other Z80 CPU card. It features the 2K ZAPPLE monitor in ROM, 2K of fast RAM, 2 serial I/O ports (either RS232 or current loop), one parallel I/O port and a 1200 baud cassette interface - in One slot at a very large cost savings over discrete boards with no compromise in performance. This one board plus a ZPU provides COMPLETE system capability. DELIVERY: Starting Mid-December - from stock to 30 days.

the Mother - $99

Here's how to get the versatility and power of the S100 bus without breaking your pocketbook. Get the MOTHER! It's a 6 slot mother board and power supply combo that features easy expansion, a husky power supply with current capability to spare, and on board logic for sense switches and resetting. We are currently supplying hundreds of these units to commercial users - it's a solid performer. The kit price is $99 - DELIVERY: Starting in December from Stock to 30 days.

Text Editor- $15

The Zapple Text Editor occupies only 3½K of core and offers full manipulation of characters, lines, or blocks of text. Features include insertions, deletions, searches, additions and much more. It is recommended for use with our assembler - as well as the starting point for any word-processing system. DELIVERY:From Stock

What more could you ask for?

Zapple Basic - $15

ZAPPLE BASIC occupies only 7½K of core and yet has all the power of Altair 8K and most of the features of 12K plus numerous unique features of its own. Among these are RENUMBER and LIST VARIABLE statements, it's ROMable, it uses the ZAP or ZAPPLE monitors for I/O (for hardware independency plus TREMENDOUS I/O power), it's 20% faster than Altair and it's relocatable. DELIVERY:From Stock.

the Zapple Monitor - $15

The ZAPPLE Monitor occupies 2K and offers more system management capability than any other monitor available to the hobbiest. It features 27 instructions including 2 which are user definable, complete debug handling (examine and modify registers, multiple breakpoints, search commands etc.) and powerful I/O management (load and dump binary and hex files, hex math, display, examine, modify memory byte by byte or by blocks etc.).Documentation includes the complete source listing. DELIVERY: From Stock.

the Relocating Macro-Assembler - $15

This is the most sophisticated assembler ever produced for a micro-processor. It is a high-powered tool for the user who demands the best, for NO other assembler even comes close to the power of this package. And yet its complete and straight-forward documentation makes this power available to the novice as well. It occupies 8½K of core, generates relocatable object code, allows infinite nesting of Macros, and much much more. DELIVERY: From Stock

The prices listed above are exclusively for hobbiest user's of TDL's ZPU in hobby applications. Non-ZPU users and commercial applications carry a price of $150 per program. All TDL software is written for the Z80 and is relocatable. Soon to-be-released packages include FORTRAN IV with hardware multiply/divide, an excellent DOS, and Disc Basic.

HOW TO ORDER Just send check or money order, or use your BankAmericard or Mastercharge, and your orders will be shipped to you postpaid. COD orders must be accompanied by a 25% deposit. Your credit card order must include the serial # of the card, expiration date, and your order must be signed. New Jersey residents add 5% state sales tax. For more information, send for our free catalog.

TECHNICAL DESIGN LABS

Z80

Research Park, Bldg. H
1101 State Road
Princeton, New Jersey 08540
(609) 921-0321

Chip Selection and Addressing — The minimum system configuration permits direct selection of the ROM, RAM, ACIA and PIA without the use of special TTL select logic. This is accomplished by simply wiring the address lines A13 and A14 to the Enable or chip select lines on the memories and PIA. This permits the devices to be addressed as follows:

DEVICE	A14	A13	HEX ADDRESSES
RAM	0	0	0000–007F
PIA	0	1	2004–2007 (Registers)
ROM	1	1	6000–63FF

Other addressing schemes can be utilized which use any combination of two of the lines A10 through A14 for chip selection.

Peripheral Control — All control and timing for the peripherals that are connected to the PIA is accomplished by software routines under the control of the MPU.

Restart and Non-Maskable Interrupt — Since this basic system does not have a nonvolatile RAM, special circuitry to handle loss of power using NMI is not required. Circuitry is, however, required to insure proper initialization of the MPU when power is turned on. This circuit should insure that the Restart signal is held low for eight Ø1 clock cycles after the Vcc power supply reaches a voltage of approximately 4.75 volts DC. Also, in order to insure that a PIA or ACIA is not inadvertently selected during the power-on sequence, Three-State Control (TSC) should be held high until the positive transition of Restart.

HALT — The Halt line is tied to Vcc and will automatically place the MPU in the run state when power is turned on. This signal may be used to halt the MPU if a switch is used to tie the line to ground for HALT and to Vcc for RUN.

The basic microcomputer system can be altered or expanded on in many different ways. For example, the S6850 Asynchronous Communication Interface Adapter (ACIA) can be substituted for a PIA, to enable the microcomputer to interface with a telecommunications modem. Or, additional memory can be added — either RAM or ROM — to expand the processing capability of the MPU. In general, the system can be expanded in a modular manner, by adding onto the bus as many as ten devices out of the S6800 family of modules. These additional modules can be any combination of memory or I/O IC circuits. In this manner a system of nearly any complexity and configuration can be assembled. Microcomputer system configurations requiring more than ten devices on the MPU bus require the addition of address and data bus buffers to operate at full speed.

By building your microcomputer from the S6800 family of devices, you take full advantage of the compatibility of the devices. They all conform to the MPU bus discipline, all are compatible in load levels, and the entire system runs on a common system clock. In effect you eliminate most all circuit design, save for the simple clock and power-up restart circuits. Because you are dealing with only a small number of integrated circuits, PCB circuit layout is simple and the entire microcomputer can be located on a single small circuit card.

ARTICLE BACKGROUND MATERIAL

The majority of the material for this article was gleaned from AMI's excellent documentation with the intent of not redoing good work just for the sake of it. Hopefully I have organized this material and clarified it to the extent of making it clearer and easier to understand which was the intent.

Next month I will cover the hardware mechanization of the AMI, EVK Microcomputer Prototyping boards.

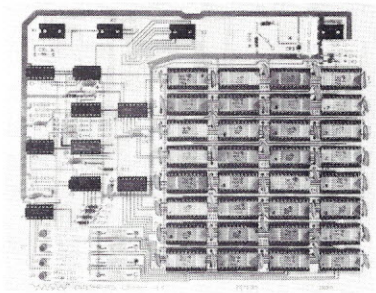
Want more information on AMI's microcomputer chip set? Write or call:

American Microsystems, Inc.
3800 Homestead Road
Santa Clara, Calif. 95051
Phone (408) 246-0330

Merry Christmas

Happy New Year

LOW COST MEMORY
16K x 8 BIT DYNAMIC RAM



Model	Description	Price
WWW-16KA	Fully Assembled	$650.00
WWW-16KK	Kit	$550.00

- 270 nsec Access Time
- 470 nsec Read/Write Time
- TTL Compatible Address Buss
- Tri-State Data Buss Driver
- Fully Socketed
- Sphere Compatible
- Easy Homebrew Interface
- Voltages +12, +5, −5

W W W ENTERPRISES
P.O. Box 548, Harbor City, Ca 90710
(213) 835-9417

CIRCLE INQUIRY NO. 29

DIGITAL DATA RECORDERS

USING 3M DATA CARTRIDGES





BRAND NEW DESIGN

Featuring the radically new "UNIBOARD" method of construction of data cartridge drives. The major computer manufacturers are changing from cassettes to cartridges at a rapid pace because of freedom from binding and greater data reliability. Now, these professional type units are priced within the range of all data users. Being made primarily as OEM data storage units for the world's major manufacturers, these units, together with controller board and software ROM, are being made available to the individual user as well.

*Appearance and specifications may be changed slightly following acceptance tests now being conducted by OEM users.

MODEL 3M3

199.95

MODEL 3M3—Uses the 3M Data Cartridge, Model DC300. This cartridge contains 300 feet of .250 tape in a sealed container. Records and plays at 9600 baud NRZ, 4800 baud P.E. Nominal speed 8" per second. Max. recommended flux density 1200 fcpi. Using four tracks, you can store nearly 2 megabytes of data on a cartridge. Cartridge measures 4" by 6". Turns counter indicates tape position. Inter-record gap light gives more accurate position 2SIO(R) is *not* required for use, but is highly recommended for 8080 and Z80 systems.

COMMON SPECIFICATIONS: FULL SOFTWARE CONTROL of record, play, fast forward and rewind. LED indicates inter-record gaps. EOT and BOT are sensed and automatically shut down recorder. Can also be manually operated using the switches on top which parallel the software control signals when not under software control. Signal feedback makes it possible to software search for inter-record gaps at high speed. 117 V—60 Hz—5 watts.

TWO I/O PORT CONTROLLER WITH ROM—Controls your terminal and one or two cassettes or cartridge units. On board ROM (For 8080 and Z80) has terminal and cassette software for turn on and go operation. NO MORE BOOTSTRAPPING. Plug in compatible with Altair and IMSAI. Loads and Dumps memory in Hex from the keyboard, formats tape files, punches tape, functions as a word processor and searches for files and four letter strings within files. Keyboard controls the cartridge units above on rewind and fast forward. Special keyboard codes enable you to dump and read Phase Encoded tapes as well as NRZ tapes. (Including K.C. Std.) Call routines give access to these from your software.

MODEL 2SIO(R) With 1 ROM for NRZ Cassettes $169.95
(Assembled & Tested) (Half of above Program)
With 2 ROM's for Data Cartridges and P.E. cassettes.
$189.95 (Full Program)
Kits available for $30 off above prices.

OVERSEAS: EXPORT VERSION — 220 V—50 Hz. Write Factory or—Datameg, 8011 Putzbrunn, Munchen, Germany; Nippon Automation 5-16-7 Shiba, Minato-Ku, Tokyo; EBASA, Enrique Barges, 17 Barcelona, Spain; Hobby Data, SpireaVagen 5, Malmo, Sweden; G. Ashbee, 172 Ifield Road, London SW 10-9AG.

MODEL 3M1

169.95

MODEL 3M1—Uses the 3M Data Cartridge type DC100A. This cartridge contains 150 feet of .150 tape and is the same cartridge used by H.P. and others. Runs at 4800 baud NRZ, 2400 baud P.E. Tape speed adjustable, but nominally set at 5"/second. Maximum recommended flux density 1200 fcpi. Cartridge measures 2-1/8" by 3-1/4". This model is ultra compact, yet extremely capable. It is intended for word processing, mailing list use and other applications requiring the compact storage of data. Data location is by inter-record gaps and automatic file search. See Common Specs and 2SIO(R). 2SIO(R) is *not* required for use, but is highly recommended for 8080 and Z80 users.

For 8080 and Z80 users: Comes complete with software program listings for the programs on the 2SIO(R) ROM. 6800 software is being written, but not yet completed. These programs give *FULL SOFTWARE CONTROL.*

CARTRIDGE AVAILABILITY: Cartridges are made by 3M, ITC, Wabash and others. They are available at all computer supply houses and most major computer service centers. We can also supply them at normal current list prices.

NEW: AUDIO CASSETTE INTERFACE* Phase Encoding interface for use with audio cassettes or NRZ recorders. Runs 2400 baud phase encoded on good quality audio cassette recorders. May also be used with 2SIO(R) to use the 2SIO(R) cassette programs with your audio cassette player. Can also accommodate "Tarbell" tapes and K.C. Std. tapes.
$50.00, Wired & Tested.
$35.00, Kit Form.

***NOTE: You do not require an interface with the 3M1 and 3M3 unless you Phase Encode. But, you do need an interface to use the 2SIO(R) with your own audio cassette.**

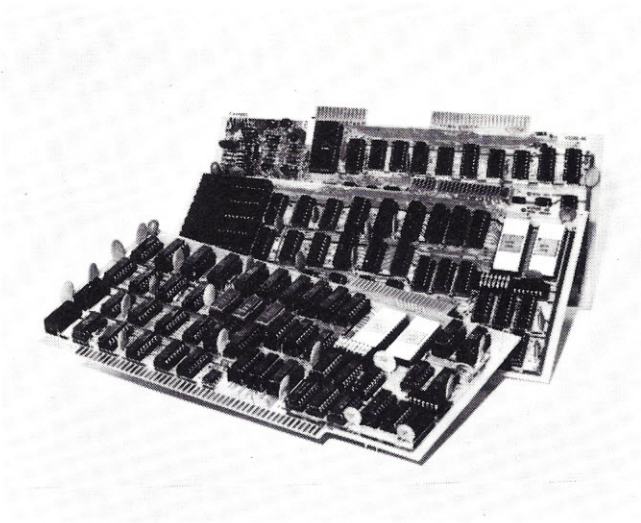
"COMPUTER AID" and "UNIBOARD" are trademarks of the NATIONAL MULTIPLEX CORPORATION. The 3M Data Cartridges are covered by 3M Patents and Marks. "UNIBOARD" Patents Pending.

For U.P.S. delivery, add $3.00 each item. Overseas and air shipments charges collect. N.J. Residents add 5% Sales Tax. WRITE or CALL for further information. Phone Orders on Master Charge and Bank-Americard accepted. MC BA

NATIONAL MULTIPLEX CORPORATION

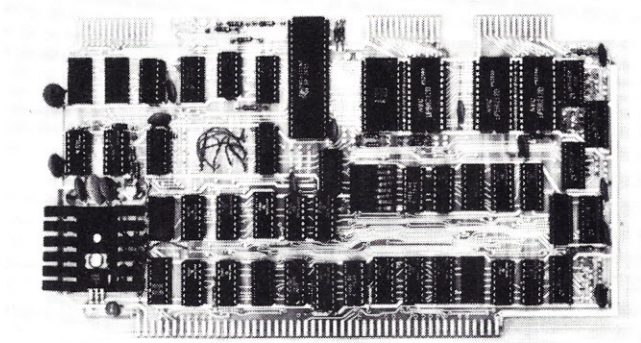
3474 Rand Avenue, South Plainfield, N.J. 07080, Box 288.
Phone (201) 561-3600 TWX 710-997-9530

CIRCLE INQUIRY NO. 30



IMSAI VIDEO DISPLAY
Assembled $1199.00/Unassembled $699.00

IMSAI MULTIPLE I/O BOARD
Assembled $350.00/Unassembled $195.00



There's another side of IMSAI you should know

Sure you know our IMSAI 8080 computer. Its size, quality, performance and price set the industry standard for value. There's another, equally important side of IMSAI—our broad and ever growing I/O product line. Right now IMSAI offers an array of sensibly priced, versatile, high-quality interfaces and peripherals that live up to the IMSAI 8080 for quality, technical leadership, and value.

IMSAI VIDEO DISPLAY. We call it the most powerful, flexible video display interface available. With up to 3 boards that fit into your IMSAI you can display color characters and color graphics simultaneously. · Unlimited image control. · Large capacity display. · Eight colors; 7 half tones. · All cables included. · Full ASCII character set. · Character blink, reverse video, multiple cursor and double-width characters.

IMSAI KEYBOARD. 53-key, ASCII encoded keyboard with good touch quality and upper case alphanumeric keys that duplicate functions of the ASR-33. Supplied with commercial grade cabinet and cable. Interfaces to any 8-bit parallel port.

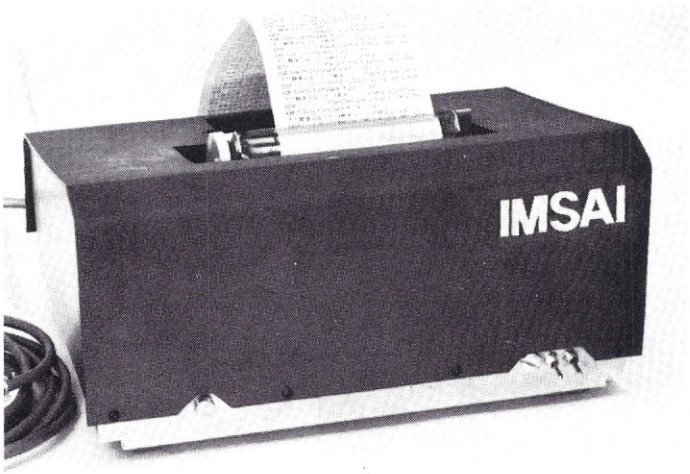
IMSAI 44 COLUMN PRINTER. 44 column dot matrix printer offering hard copy output at an affordable price. Interfaces to many computers using an 8-bit parallel output port. Simple programming and installation. Self-contained with case, cable, power supply, timing, control and character generation included. Produces 75/lines/min.; double size characters software selectable.

IMSAI MULTIPLE I/O BOARD. Simultaneous control of keyboard, printer, tape cassette (Byte or Tarbell) and teletype (or CRT) by a single MIO board. Our 5-port, multiple I/O board combines the most commonly used I/O interfaces including a cassette interface. two parallel I/O ports, one serial channel and one control port—all on one board!

And many other **IMSAI** I/O interfaces to expand your system. Examples:

IMSAI Programmable Parallel I/O board offering 6-ports for the ultimate in I/O flexibility and control.

IMSAI PRINTER
Assembled $549.00/Unassembled $399.00



IMSAI KEYBOARD
Assembled $199.00



IMSAI 2-Channel serial I/O board with 3 modes for total versatility in communications.

IMSAI 4-Port Parallel I/O board with LEDs for visual observation of data flow.

IMSAI Intelligent Breadboard for easier, more accurate circuit design and classroom instruction.

IMSAI 4K RAM—the best price performance 4K RAM board on the market.

Socket sets for all boards. Use for easier board maintenance.

For commercial application—Our IMSAI floppy disc with disc operating system and extended BASIC.

Yes, the other side of IMSAI has much to offer. It's a complete I/O line with products that match the IMSAI 8080. We offer a detailed, illustrated catalog describing the IMSAI 8080, its options, peripherals, software, prices and specifications. Send one dollar to cover handling. Write or call for name of the nearest dealer.

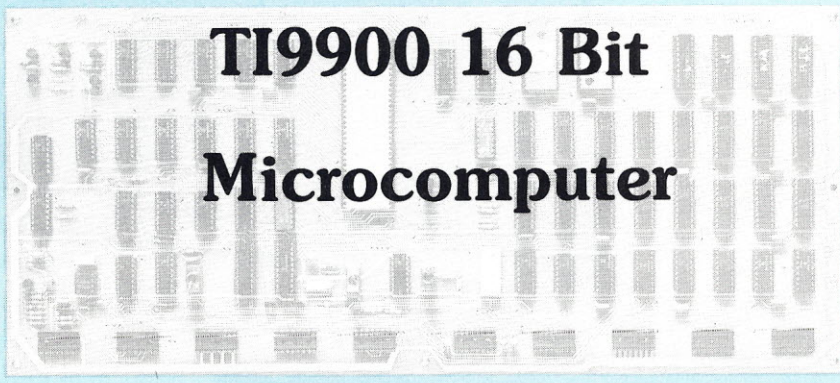
Dealer inquiries invited.

IMSAI

IMSAI Manufacturing Corp.
14860 Wicks Boulevard
San Leandro, CA 94577
(415) 483-2093
TWX: 910-366-7287

The Technico Super Starter

TI9900 16 Bit Microcomputer



By Terry Dollhoff

INTRODUCTION

The TI 9900 microprocessor was introduced by T.I. nearly one year ago, and it was only a matter of time before it found its way into the hobby market. The first TI 9900 entry is the Technico Super Starter™ kit. The Super Starter not only includes the new 16-bit TI 9900 but incorporates a number of other unique design features. The entire kit is on one single 7 x 16 inch printed circuit board and sells for $269 in kit form and $369 assembled and tested.

SYSTEM

The Technico Super Starter system is illustrated in Figure 1. At the heart of the system is the new 16-bit processor — the TI 9900. The TI 9900 is the most significant new microprocessor development of the past year. It has a full 16-bit word minicomputer instruction set including a hardware multiply and divide. In fact, the TI 9900 is software compatable with the TI 990 series minicomputer.

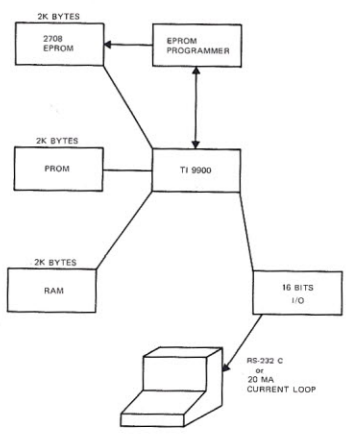


FIGURE 1.

The Super Starter kit provides three different types of user memory:

PROM — Four fusable link PROM's are provided for permanent storage. Two PROM's are provided with the kit. These PROM's are preprogrammed with a powerful terminal monitor. This monitor provides a number of commands for program development.

EPROM — Two EPROM sockets are provided. These EPROMs (2708) provide 2K bytes of program storage. The unique feature of the EPROM circuit is that the EPROMs can be programmed also. Thus, a convenient means is provided for storing your programs in non-erasable memory. The EPROMs themselves are not provided with the kit, but must be purchased separately.

RAM — The kit provides 2K bytes of on-board RAM. 512 bytes are provided with the kit. The memory expansion is accomplished by merely inserting the additional chips.

The Super Starter includes two 16-bit parallel input/output ports. Two of the input bits and two of the output bits are used by the monitor to control the terminal and EPROM programmer. If you are not using the monitor, straps are provided to remove the monitor related circuits. The terminal related input/output is both RS 232C and 20ma current loop compatible. Most terminals can be used with the kit.

As already mentioned, the Super Starter includes an EPROM programmer. Actually, it includes two of them. Since the TI 9900 is a 16 bit machine, both EPROMs are programmed simultaneously. The only thing required to program EPROMs is a +28V power supply.

MONITOR SOFTWARE

The 512 word monitor included with the kit makes it immediately usable with your terminal. The monitor includes all of the following commands:

Alter — inspect or modify the contents of RAM.

Breakpoint — establish a software breakpoint in the user program. When the breakpoint is reached during execution of the user program, control is returned to the monitor.

Copy — move one area of memory to another.

Dump — dump an area of memory on the terminal. If the dump is punched on tape, it may be reloaded with the Load command.

Go — transfer control to a user program.

Hex — calculate the hexadecimal sum and difference of two hexadecimal numbers.

Load — reload a dump produced by the monitor.

Modify Output — set or clear an individual output bit.

Inspect Output — inspect the current setting of an input bit.

Program — program the on-board EPROMs.

Snap — establish a snap in the user program. Snap is a dynamic breakpoint. Each time the snap is reached, control is transferred to the monitor, designatad registers or memory are dumped on the terminal, and then control is returned to the user program. This command is useful for debugging complicated loops.

Workspace Dump — display the user registers.

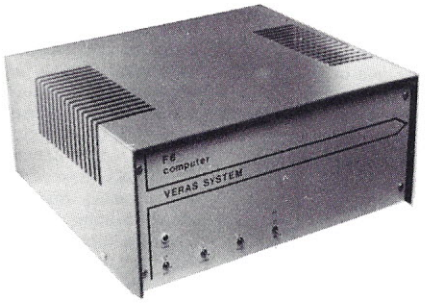
All of the above commands are implemented in 512 words (1K bytes). This is a good testimonial for the power of the TI 9900 instruction repertoire. As an option, the Super Starter also offers a 512 word mini-assembler called the Instant Input Assembler. This program is distributed in two additional fused link PROMs which may be plugged into the on-board expansion area. This mini-assembler allows the user to enter programs in assembly language.

CONCLUSION

The Super Starter kit may well be the most complete single board kit on the market, but Technico also plans a series of add-on boards. Like the basic kit, the add-on boards include more than the minimum necessary circuits. For example, their add-on RAM board (same size as the kit) will have 32K words of memory! They will also offer a fused link programmer, an expansion I/O board, and expansion EPROM and PROM boards. It looks like the TI 9900 has finally reached the hobby market — in a big way.

WHO DARED TO CHALLENGE THE 8080 & 6800 SYSTEMS?

WE DID!



7" x 16" x 14-3/4"

VERAS SYSTEMS "F-8"

A COMPLETE SYSTEM
FOR ONLY $459.00 KIT FORM
$709.00 ASSEMBLED and TESTED

COMPARE STANDARD FEATURES ON BASIC SYSTEMS YOU'LL SEE WHY THE VERAS F-8 SYSTEM WINS HANDS DOWN!

*Registered Trademarks of Fairchild and Motorola

STANDARD FEATURES	VERAS F8	8080 & 8080A SYSTEMS	6800 SYSTEM
Parallel I/O Ports	(3) 8 Bit Bidirectional Brought Out To Rear Panel Conn's.	None	None
Serial I/O Port	RS-232 or TTY Brought Out To Rear Panel Term. Strip.	None	RS-232 or TTY
Interval Timers	(2) Programmable Interval Timers	None	None
Interrupts	a) Vectored Interrupt To Location 0090 Hex. b) Vectored Interrupt Programmable Location c) Two Vectored Interrupts Associated With Interval Timers d) Total of (4) Interrupts In A User Defined Priority Interrupt Structure	None	a) 2 Non Vectored Interrupts on P I A b) 2 Vectored S W I & N M I c) Total of 4 Non Prioritized Interrupts
Built In Mini Operating System in ROM For Terminal And Memory Debug	FAIRBUG*	None	MIKBUG*
Loader Program	Automatic Internal ROM	Manual Console Switches	Automatic Internal ROM
Static RAM Memory	1024 BYTES	None	2048 BYTES
Card Rack	Rugged Alum. Self Contained Card Rack/Plastic Self Aligning Card Guides	Card Supports	None
Auxiliary DC Power To Power Peripherals	+5V, -5V, +12V, -12V @ 1 Amp. Ea. Regulated At Rear Panel Terminal Strip	None	None
Basic Kit Price	$459.00	$539.00, $599.00 or $840.00 Depending On System	$395.00

OUR 4K STATIC RAM BOARD FEATURES: (OPTIONAL)

- On board decoding for any four of 64 pages.
- Address and data lines are fully buffered.
- No onboard regulators to cause heat problems. (Chassis mounted)
- 4K memory boards with connector, buffers, static RAM's & sockets are available in kit form **$149.00**

THE VERAS SYSTEM

The VERAS System can be made into a 17K processor by merely adding four of our optional memory boards. The kit includes everything you need to build the VERAS F-8 Computer as described. All boards, connectors, switches, discrete components, power supply and cabinet are supplied. Programming manual, data book and simplified support documentation supplied, 8K Assembler and Editor (paper tape or K.C. std. cassette) available on request with minimum order of 8K RAM.

THE CPU BOARD FEATURES:

- Two I/O ports each on the CPU and ROM chip make 32 bidirectional TTI lines.
- The Fairbug* programmed storage unit provides the programmer with all I/O subroutines, allows the programmer to alter or display memory, and register its contents via teletype.
- Programmable internal timer is built into the ROM chip.
- Built in clock generator and power on reset are built into the CPU chip.
- There is a local interrupt with automatic address vector.
- It is expandable to 65K bytes of memory.
- 20 mil loop and/or RS232 interface included.
- 1K of on board 2102 RAM.
- Serial interface built into PSU chip.

*Fairbug is a registered trademark of Fairchild Corp.

TINY 2 K BASIC (AVAILABLE) OCT. 15, 1976 $25.00
FULL BASIC (AVAILABLE) DEC. 15, 1976 $50.00

Computer dealers and hobbyist club inquiries are invited. Expected delivery time 30 days or less.

The More Flexible and Expandable Computer at a Comparative Price.

VERAS SYSTEMS

Warranty: 90 days on parts and labor for assembled units. 90 days on parts for kits. Prices, specifications, and delivery subject to change without notice.

VERAS SYSTEMS
A Div. of Solid State Sales, Inc.
Box 74E, Somerville, MA 02143
(617) 547-1461

☐ Enclosed is check for $ _____
or ☐ Master Charge # _____
☐ VERAS F-8 Computer Kit ☐ Assembled
☐ 4K RAM Board Quantity _____

Name _____
Address _____
City, State _____ Zip _____

CIRCLE INQUIRY NO. 33

New Products

NOTE

As diligently as we tried, we still couldn't get everyone in the New Products Guide for November. Our apologies to TDL and Axiom Corp. These two firms definitely should have been listed.

New Ex-800 Electrosensitive Line Printer

• • •

Thanks to the economics of new hybrid and LSI technologies, the EX-800 combines high performance and user flexibility with greater simplicity and lower overall cost.



The EX-800 is a complete stand-alone printer which offers all of these specifications as *standard:*

- 96-character ASCII printout.
- Built-in self-tester for rapid system diagnosis.
- Three character sizes selectable to give 20, 40, or 80 columns per line.
- 2 lines per second for throughput of up to 160 characters per second.
- Printed character size may be preset or programmed character-by-character.
- Autoprint feature takes account of changes in character size. Never any loss of data.
- RS232C interface available.
- 96-character ring buffer accepts multiline messages.
- Quiet non-impact printing.
- High contrast printout photocopies easily.

For further information contact Axiom Corporation, 425 E. Green Street, Pasadena, CA 91101; (213) 684-2246.

CIRCLE INQUIRY NO. 90

Z-80 CPU CARD

TDL has recently announced the revolutionary Z-80 CPU Card, an ALTAIR/IMSAI compatible CPU card featuring the powerful Z-80 μP produced by Zilog Incorporated. What's so revolutionary about the Z-80?

The Z-80 is a very powerful and fast μP — in fact it's a NEXT generation microprocessor. And it's available to you in a totally compatible format, NOW. Just unplug your current CPU card, plug in the Z-80 CPU, load a program, and you're up and running — with a NEXT generation μP. The power and versatility of the A-80 is unequalled in the μP field, and it opens the door to tremendous developments in the state of the art. More powerful, faster, and less memory consuming versions of your current 8080 software are just a part of the possibilities the Z-80 provides.

Each Z-80 CPU kit comes complete with: prime commercial quality boards, IC sockets etc.; easy to follow instructions; Zilog's Z-80 Manual; Schematics; an easy to understand and apply user's guide; TDL's Z-MONITOR on paper tape (soon to be available in deluxe PROM version); and membership in the Z-80 user's group.

The Fastest Ram? The high speed capability of the Z-80 demands an extra-fast RAM to back it up, and TDL's new Z8K RAM board fills the bill. The Z8K is an 8K by 8 static RAM with the fastest access time in personal computing — 215ns. It's the only RAM in personal computing fast enough to let the Z-80 run at full speed with no wait states. If that isn't enough, it also happens to be one of the lowest powered RAMs around as well. Only 150ma typical current load on the 5V supply. That makes the Z8K run cool and perfect for battery standby operation as well. Other so-called "low power" 4K RAM boards can't compete with these specs. It's the perfect match for the Z-80, and its features and low cost make it a perfect match for ANY μP. (It's fully Altair bus compatible of course . . .) Price: $295.

For further information contact Technical Design Labs, Research Park, Bldg. H, 1101 State Road, Princeton, New Jersey 08540; (609) 921-0321.

CIRCLE INQUIRY NO. 113

Altair™ 8800/IMSAI 8080 Compatible Time of Day Clock

The time of day is now available for ALTAIR 8800, IMSAI 8080, and bus compatible systems from the new IDS model SPM-88 clock board. Current time is read from three consecutive I/O addresses which are selectable in increments of four addresses. No waits are required during clock set or read. This low power board requires less than 400 ma. from the +8V supply and is well below the ALTAIR bus power specification.

The SPM-88 keeps time using the 60 cycle AC line as a reference source (which is very accurate), but provisions are also included for optional 50 Hz line sources, onboard crystal controlled time base, and external battery backup power.

Software is included with the SPM-88 kit to set and read the clock from MITS BASIC, Processor Technology BASIC5, and from assembler for non-BASIC applications. Software is also included to maintain either calendar or Julian date if desired.

The SPM-88 is available in kit form for $96.00 postpaid and is complete with all necessary components and instructions. Options include IC sockets for all ICs ($10.00), crystal time base ($25.00), 50 Hz operation instead of 60 Hz (no charge, specify SPM-88/50). Delivery is stock to 30 days.

For further information contact International Data Systems, Inc. P.O. Box 593001, Miami, FL 33159.

CIRCLE INQUIRY NO. 91

S.D. Sales Co. Announces New Z-80 Board for Less than $150

S.D. Sales of Dallas TX, has released their newest product. A Z-80 board completely compatible for use in Altair and IMSAI Microcomputers. The board is directly interchangeable with existing 8080 based boards. Special features include: stops in MI state, on board sync generation for Bus., in addition to all of the standard features found with using the Z-80 microprocessor. Advanced circuitry is standard as with all products produced by S. D. Sales. The board is in kit form including all sockets, plated through holes, and excellent quality components.

For further information contact S.D. Sales, P.O. Box 28810-E, Dallas, TX 75228.

CIRCLE INQUIRY NO. 92

Time-Sharing-Service Supports Business-Use of Micro-Systems

Quikdata Timesharing Service is now operating over (213) & (714) datalines at 110/300/1200 bauds. Its unique features are free program use for many commercial and engineering applications, written in business basic and table-driven. Changes in logic and I/O formats are easily implemented mostly without reprogramming. Remote job entry, spooling, free format, batch data editor are standard options. Remote users will find the service most economical because data files can be polled during the night and processed for printout from cassette or floppy disc next morning. It is a cost efficient extension of microprocessors for large volume EDP-tasks using 1200 baud dial-up telephone lines. Typical phone-charges coast to coast are 1 cent/600 bytes between 23:00 to 8:00 and on weekends.

The time-sharing system provides on-line the latest version of all user manuals including computer assisted instructions for a reportgenerator resembling English language to prepare reports without help from programmers.

Commercial applications are: Order-entry, invoicing (E.G. 100 invoices/day with 120 items each); inventory control; production scheduling for job-shops; engineering support; change-order control; wiring lists; logical design aids; plotting of circuit diagrams and P.C. artwork.

For the hobbyist: computer assisted instruction in basic and assembly language; translators among various basic and assembler dialects; software exchange with 30% royalty for the author.

Minimum configuration requires basic language with I/O control for cassette or floppy disk and originate modem; next phase uses polling according to protocol in basic.

For further information contact Quikdata, c/o Ernest J. Schubert, 3431 Cerritos, Los Alamitos, CA 90720.

CIRCLE INQUIRY NO. 93

Z-80 Reference Card Offered

Z-80 reference card makes a good working tool. It contains all mnemonics, flags, op codes (696 of them), formats (9 of them), and symbolic operations of the Z-80 microprocessor. All of this is concisely and clearly contained on one letter size card for ease of access and handling.

For further information contact Z-80 Card, Fred McNeill, P.O. Box 6305, Denver, CO 80206.

CIRCLE INQUIRY NO. 94

Peripheral Prom Programmer/Duplicator

The Series 92 Peripheral Programmer/Duplicator is a low cost, highly versatile solution to PROM programming and PROM duplicating requirements. This field-proven system is designed to interface with teletypes, microprocessor development systems, terminals, computers and other external devices or operate as a stand-alone PROM duplicator.

The Series 92 uses the same plug-in Personality Modules as its companion Series 90 Universal PROM Programmer and all modules are interchangeable between these instruments. (See PROM USER'S GUIDE for complete listing).

FEATURES: programs, lists, duplicates and verifies PROMs via ASR-33 TTY compatable interface; duplicates PROMs, as a stand-alone system; optional RS-232C or 8-bit parallel I/O interface offers program and list modes of operation; uses existing, field-proven PM9000 series Personality Modules; more than 40 Personality Modules program over 100 different PROMs.

FUNCTIONS: PROGRAM: data is programmed into the copy PROM from any compatible external source, i.e., ASR-33, RS-232C, Parallel I/O. Each bit is verified as it is programmed; any error causes the "Fail" light to illuminate. LIST: data in the Copy PROM is outputted sixteen words to the line, with a space between each word and carriage return-line feed at the end of each line. DUPLICATE: data in a Master PROM or TTY tape is automatically programmed into the copy PROM. If a location cannot be programmed, the fail light illuminates and, if connected, the TTY prints the address and the data actually at that address in the copy PROM. VERIFY: data in Copy PROM is compared with data from TTY tape reader. If a location does not verify, the TTY prints the address and data at that address. RUN-FAIL: while a Series 92 is programming a PROM, the run indicator is lighted. After program-

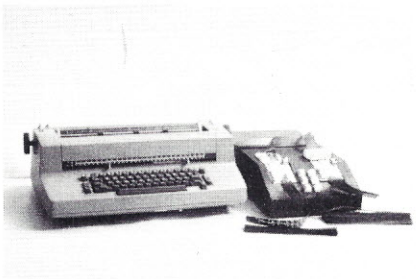
ming at each address a verification is performed. The Fail indicator is lighted if the verification located an error.

For further information contact Pro-Log Corporation, 2411 Garden Road, Monterey, CA 93940, (408) 372-4593, TWX: 910-360-7082.

CIRCLE INQUIRY NO. 95

New Selectric Conversion Kit Offered

Sharp and Associates of Lakewood is delivering an IBM Selectric conversion kit designed to be a high speed, high quality replacement for the ASR 33. It incorporates an interface for a 30 cps paper tape reader and punch and recognizes on-off commands for the paper tape, along with a PRINT-ON, PRINT-OFF command pair, allowing full speed operation of the reader-punch mechanism.



The interface is accomplished by serial transfer, selectable at either 110 or 300 baud, with sockets for RS232 and current loop components. Fully assembled and tested units, converted new Selectric II Mechanisms, and conversion of used model I mechanisms are offered also.

For further information contact Sharp and Associates, P.O. Box 26045, Lakewood, CO 80226.

CIRCLE INQUIRY NO. 96

The Volksmeter Plus

Now available thru I.C. Electronic Supply is Non Linear Systems, LM-3.5 Digital Multimeter. The Volksmeter Plus is a 3½-digit meter (3 full digits plus 100% over-range). It is a true multifunction, multirange meter that will fit in the palm of your hand. Self contained portable operation on battery or 115V AC operation.



Other features include: four ranges of DC and AC volts to 1000 VDC or peak AC with 1 millivolt resolution on the 2 volt range. The input impedance is 10 meg-ohms on all voltage ranges to eliminate circuit loading. The LM-3.5 can be dropped without damaging and moved without recalibration and is accurate to 1%. This fantastic meter retails for $147.00 with input leads, rechargeable batteries, charger and current shunts.

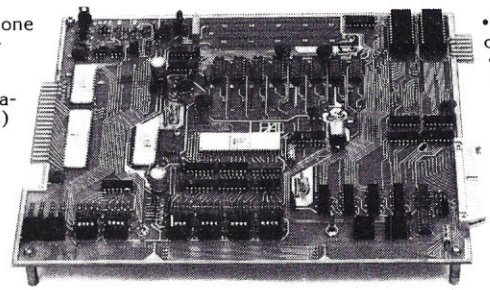
For further information contact I.C. Electronic Supply in Van Nuys, (213) 894-8171, San Diego, (714) 292-5484, and Orange, CA (714) 997-5343.

CIRCLE INQUIRY NO. 97

Prototyping Board

The PB-1 Prototyping Board from Electronic Control Technology is plug-in compatible with the ALTAIR/IMSAI bus. It aids the creative user in prototyping special or new circuits for the micro-

If you want a microcomputer with all of these standard features...



- 8080 MPU (The one with growing software support)
- 1024 Byte ROM (With maximum capacity of 4K Bytes)
- 1024 Byte RAM (With maximum capacity of 2K Bytes)
- TTY Serial I/O
- EIA Serial I/O
- 3 parallel I/O's
- ASCII/Baudot terminal compatibility with TTY machines or video units
- Monitor having load, dump, display, insert and go functions
- Complete with card connectors
- Comprehensive User's Manual, plus Intel 8080 User's Manual
- Completely factory assembled and tested—not a kit
- Optional accessories: Keyboard/video display, audio cassette modem interface, power supply, ROM programmer and attractive cabinetry... plus more options to follow. **The HAL MCEM-8080. $375**

...then let us send you our card.

HAL Communications Corp. has been a leader in digital communications for over half a decade. The MCEM-8080 microcomputer shows just how far this leadership has taken us...and how far it can take you in your applications. That's why we'd like to send you our card—one PC board that we feel is the best-valued, most complete microcomputer you can buy. For details on the MCEM-8080, write today. We'll also include comprehensive information on the HAL DS-3000 KSR microprocessor-based terminal, the terminal that gives you multi-code compatibility, flexibility for future changes, editing, and a convenient, large video display format.

HAL Communications Corp.
Box 365, 807 E. Green Street, Urbana, Illinois 61801
Telephone (217) 367-7373

NEW: from MATRIX PUBLISHERS

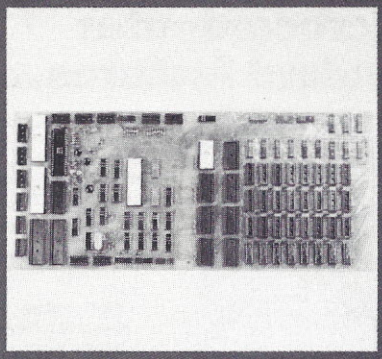
MICROCOMPUTER DICTIONARY AND GUIDE
Charles J. Sippl and David A. Kidd
Over 8000 definitions and explanations of terms and concepts relating to microprocessors, microcontrollers and microcomputers. Special sections on programmable calculators; math and statistics definitions; flow chart symbols and techniques; binary numbers and other related computer terms. There is also a comprehensive electronic/computer abbreviations and acronyms section. 704 pages.
Price: $17.95

PROGRAMMABLE CALCULATORS
Charles J. Sippl
An introductory textbook on calculators that reviews calculator capabilities, usage and programming from the basics of how to use keyboards, special function keys and preprogrammed units to advanced programmable calculator systems for use in engineering, science and communication. Includes a section on programming processes and procedures for calculators and a glossary of calculator terms.
Price: $11.95

1024 QUESTIONS AND ANSWERS ABOUT HOME COMPUTERS
Richard L. Didday
A book for the person interested in microcomputers who wants to get an idea of what it can be like before buying the equipment and for the person with a microcomputer who wants ideas for things to do, help in reading the literature, help in deciding what ways to go. 144 pages.
Price: $4.95

MATRIX

MATRIX PUBLISHERS, INC.
Dept. IF, 207 Kenyon Rd. Champaign, IL 61820
Matrix books also available in Byte Shops, computer stores, and bookstores.



Microprocessor Quay 80MPS. For serious hobbyists.

Quay 80MPS is not designed for the casual hobbyist. Only if you're serious about your personal computing, should you find out about Quay 80MPS's features, capabilities, and options. Only if you want to break free from hobby-class microprocessors and enter a great new world of sophisticated computing experiences, should you get into the Quay 80MPS.

Features

- ☐ **Single PC board.** 16 pin dip connectors (no costly backplane or edge connectors.)
- ☐ **Z-80 CPU.** 158 instructions, 2.5 MHz clock.
- ☐ **4K dynamic RAM.** Expands to 16K on board (Z-80 refreshes w/o loss of thruput).
- ☐ **1K UVEPROM monitor.** Inspect, alter, dump, and load memory; set breakpoints; trace and single-step debugging; handles serial I/O.
- ☐ **7 additional UVEPROM sockets.**
- ☐ **4 8-bit parallel I/O ports.** Vectored interrupt (2 Z-80 PIO's, expands to 4).
- ☐ **1 socket for Z-80 4 channel counter timer.**
- ☐ **1 UART.** RS232 & 20 ma interface.
- ☐ **UVEPROM programmer (2708).**
- ☐ **Fully buffered address, data and control.**

Quay 80MPS is $695, assembled and tested. Send for complete details. Or for fast action, Call 201-681-8700.

Mastercharge and BankAmericard accepted. COD with 1/3 deposit. N.J. residents add 5% sales tax. Price does not include shipping and handling.

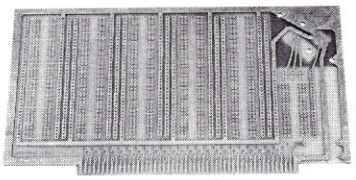
Dealer inquiries invited.

Quay CORPORATION

P.O. Box 386, Freehold, N.J. 07728.
Phone: 201-681-8700

CIRCLE INQUIRY NO. 36

computer. Space is available for up to 27 IC's with 14 pins and it can accept other size IC's or discrete components in any location.



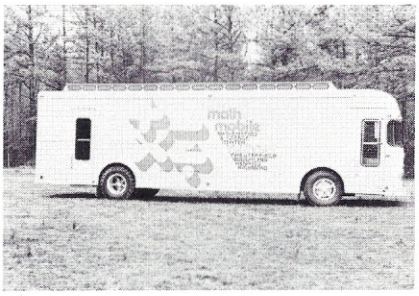
The PB-1 is specifically designed for point-to-point soldering but can also be used for wire wrap. The board is made from G-10 material and has gold over nickel plated fingers. Included also are a massive heat sink and a 5V regulator. PB-1 Prototyping Board, $22.00, Shipping and handling, $2.00.

For further information contact Electronic Control Technology, P.O. Box 6, Union, NJ 07083.

CIRCLE INQUIRY NO. 98

Vadic Modems Used in Traveling Schoolroom

Vadic modems play an important role in a unique traveling classroom that can go from school to school to provide computer-assisted mathematics instruction programs for schools in the city of Richmond, and the Virginia Counties of Henrico, Goochland and Chesterfield.



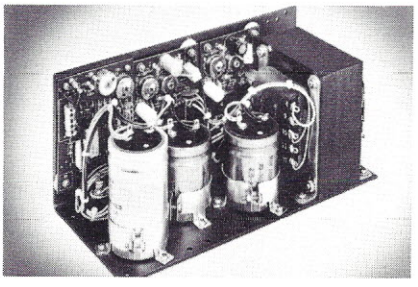
The Mathmobile is equipped with eight interactive student terminals (General Electric Terminet 30 teleprinters), which operate on-line via a telephone with the computer center located in Glen Allen, Virginia. The students at the various schools use their hard-copy terminals principally to engage in drill and practice in mathematics, and all programming, processing and record keeping are functions of the CPU, a Hewlett-Packard 2000F.

For further information contact Tom McShane, Vice President of Marketing, The Vadic Corporation, 505 East Middlefield Road, Mountain View, CA (415) 965-1620.

CIRCLE INQUIRY NO. 99

SMS Series Multi-Output DC Power Supplies for Peripheral Memory Equipment

Six basic models fulfill the requirements for virtually any peripheral memory system such as floppy-disc, magnetic tape, cartridge, etc. equipment. These multi-output units come in voltage combinations of 5, 12, 15 and 24 Vdc, with line and load regulation to ±0.1% and only 50mV ripple.



Their 115/230Vac ±10% inputs are fully rated from 47 to 440Hz. Overvoltage protection is included on all +5Vdc outputs. They are available from local distributors at single unit prices starting from $109.00.

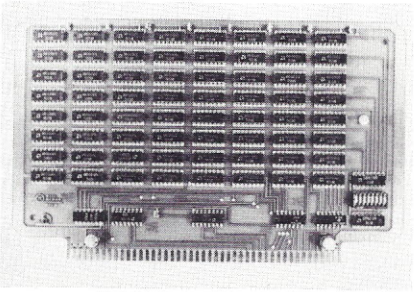
For further information contact Standard Power, Inc., 1400 So. Village Way, Santa Ana, CA 92705, (714) 558-8512.

CIRCLE INQUIRY NO. 100

8K Static RAM Module Is EXORciser* Compatible

The 9626 is a fully static random access memory module specifically designed for compatibility with the M6800 microprocessor bus. It is pin and outline compatible with the Motorola Exorciser* and MEK6800D1 Evaluation kit and provides 8192 bytes of storage, featuring

- High speed (450 NS max access time)
- Low power (10 watts max)
- Low data hold time (10 NS max)
- Low bus loading (.4 MA M X)
- Single 5 volt power required
- Switch selectable operating region



The 9626 is one of a family of M6800 support modules. All cards of the family are 6.05 inches by 9.75 inches and utilize a 43 pin dual readout edge connector with 0.15625 inch pin spacing.

Unit price for the 9626 is $350. 100 level price is $210. Delivery is from stock to 30 days.

For further information contact Creative Micro Systems, 5231 Loyola Ave., Westminster, CA 92683 (714) 892-2859.

*EXORciser is a trade mark of Motorola, Inc.

CIRCLE INQUIRY NO. 101

Scanbe Offers Brochure on New Customatic™ Card Packaging System

Scanbe has introduced a new 10-page brochure that describes the company's innovative Customatic custom card packaging system. Simplifying a seemingly complex problem, Customatic provides a simple, effective solution to designing P.C. card packaging systems to custom or special requirements.

In using the Customatic system, the customer need only answer eight basic questions regarding his requirements, such as card size, number of cards per row, number of rows, etc. Scanbe will then engineer and recommend a custom system, quoting prices within 48 working hours. There are no complicated formulas or complex part numbering systems involved.



The brochure explains Customatic in detail and offers guidelines for answering the eight questions

along with a full page of photos showing typical custom card packaging applications. Also included are two pre-paid postage cards for convenient customer response to the questions.

Scanbe, a Division of Zero Manufacturing Company, produces a full line of standard and custom electronic packaging products, including circuit card files, socket panels and socket cards, and dual-in-line sockets.

For further information contact Scanbe, 3445 Fletcher Avenue, El Monte, CA 91731, (213) 579-2300.

CIRCLE INQUIRY NO. 102

Complete Small Computer Introduced at $995

A complete computer featuring input/output devices and interfaces, memory, software and keyboard has been introduced by Processor Technology, Inc., Emeryville, California.

The new unit, available in kit form or assembled, designated the Sol-20, is said to include more standard attributes than any other small computer on the market today. Included in the package are an 8080 microprocessor, 1024 character video display circuit, 1024 words of static low-power RAM, 1024 words or preprogrammed PROM and a custom 85-key solid-state keyboard.



Other features are an audio cassette interface capable of controlling two recorders at 1200 baud, parallel and serial standardized interface connectors, a complete power supply including fan and a contemporary cabinet with solid walnut sides.

Software includes a PROM personality module and a cassette with BASIC-5 language plus two sophisticated computer video games. The Sol-20 works with all S-100 bus products including those of Altair ™, Imsai and Processor Technology.

Heart of the Sol-20, the Sol all on one board PC kit is also available for $475.

In addition to the basic Sol-20, Processor Technology offers several plug-in PC boards which expand the computing power of the unit. These include a firmware module to allow the user to develop and run programs, memory boards to expand up to 65K bytes and an interface expansion board with two 8-bit parallel I/O ports with full handshaking logic and a serial data rate which can be set between 35 and 9600 baud.

Peripheral gear matched to the Sol-20 includes line and serial printers, perforated tape readers, floppy disk memories, black and white or color displays and A-to-D and D-to-A converters.

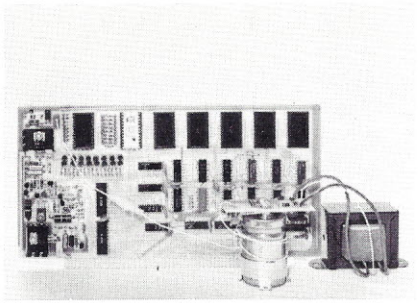
Low cost software for the Sol-20 available now consists of fast new 8K BASIC and a new 8080 FOCAL. Gamepacs include TREK 80, TARGET, ZING, LIFE, and PATTERN. Also offered are MATHPACK video calculator, 5K BASIC, and two Resident Assemblers.

For further information contact Processor Technology Corp., 6200 Hollis Street, Emeryville, CA 94608, (415) 652-8080.

CIRCLE INQUIRY NO. 103

PRAMMER from XYBEK

A PROM/RAM/PROM PROGRAMMER for the Altair 8800, IMSAI 8080 and other S100 bus micro computers. This 2K memory board contains 256 bytes of RAM and space for 1792 bytes of 1702A EPROM.



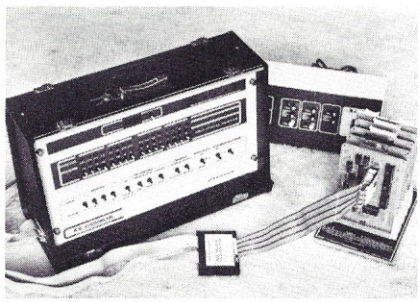
One of the 1702A sockets doubles as a 1702A programmer. The PRAMMER is not an I/O device, but occupies any 2K slice of system memory. This kit is complete with its own 80V power supply, features on board timing independent of the CPU clocks and contains its own microprogram for read and write control . . . No oneshots are used. The 256 bytes of RAM may be used for a stack, for buffers, save areas, etc., eliminating the need for use of main memory already dedicated to other application programs. Complete stand-alone software for programming, and copying 1702A EPROMs is supplied with the PRAMMER kit in a single preprogrammed 1702A. Also included are the complete listings for PRAMSYS, an eleven function development system designed to reside in the 1792 bytes of EPROM in the fully populated board and to interface with a TTY compatible terminal. Also available is a 3 foot extension kit for bringing any of the 1702A sockets to a textool zero insertion force socket external to your system. The introductory price for the PRAMMER kit is $189 and the extension kit is $15.

For further information contact XYBEK, P.O. Box 1631, Cupertino, CA 95014.

CIRCLE INQUIRY NO. 104

Analyzer Aids in Diagnosing 6800 Microprocessor Systems

A new low-cost analyzer designed to develop and debug microcomputer systems built around the Motorola 6800 microprocessor is a product of AQ Systems, marketed by E & L Instruments, Inc. The instrument can display all address, data and status information and permits direct user interaction with memory and all registers including the program counter.



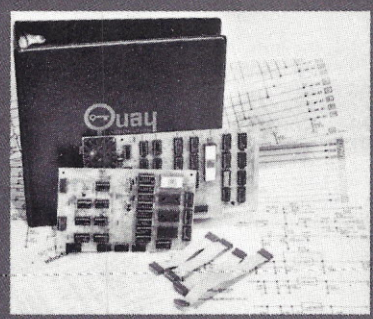
The Model AQ6800 Microprocessor System Analyzer is especially effective as a design aid in converting breadboard circuits to prototypes, and for the easy evaluation and fault analysis of microprocessor-based products in production. The addition of a buffered clip-on probe converts the analyzer into a portable production test or field maintenance instrument. The connection to the system being analyzed is easily accomplished with a buffer isolated probe terminated with a 40-pin clip that attaches directly to the microprocessor chip.

The base price of the AQ6800 is $875 and delivery is stock to six weeks.

For further information contact E & L Instruments, Inc., 61 First Street, Derby, CT., 06418, (203) 735-8774.

CIRCLE INQUIRY NO. 105

Microcomputer Quay 80AI does much more with the Z-80.



This dynamite new microcomputer system in a kit moves data like nothing else on the market. Run it alone or plug it into an S100 bus Altair/IMSAI. For solo performance, all you need is an unregulated power supply and an I/O device. Plugged in, Quay 80AI is a CPU, ROM, SIO, and RAM board—run any S100 compatible device. BUT MORE THAN THAT. Quay 80AI's Z-80 CPU opens challenging new areas of personal computing.

Features

- ☐ **S100 bus compatible.** Plugs in one slot of your Altair or IMSAI.
- ☐ **Z-80 w/2.5 MHz clock.**
- ☐ **1 K static RAM.**
- ☐ **512 byte (ROM) monitor.** Comes up running. Inspect, alter, dump, and load memory; set breakpoint; jump to user program. Handles serial I/O or keyboard input, including setting baud rate.
- ☐ **4 UVEPROM (2708) sockets.**
- ☐ **Serial I/O.** RS-232 and 20 ma interface.
- ☐ **Parallel keyboard input.** Accepts standard ASCII keyboard.
- ☐ **UVEPROM programmer.** Program 2708 type UVEPROMs.
- ☐ **2 phase clock and sync.** Run S100 compatible peripherals.
- ☐ **158 instructions.** All 78 8080 instructions plus 80 new powerful instructions.
- ☐ **On board voltage regulators.**

Quay 80AI in a kit is $450; factory assembled, $600. Send for complete details. Or for fast action call 201-681-8700.

Mastercharge and BankAmericard accepted. COD with 1/3 deposit. N.J. residents add 5% sales tax. Price does not include shipping and handling.

Dealer inquiries invited.

Quay CORPORATION

P.O. Box 386, Freehold, N.J. 07728
Phone: 201-681-8700

CIRCLE INQUIRY NO. 37

Call Your IMS Dealer Today

ARIZONA: Phoenix, Arizona Micro Systems, (602) 993-4278; **Tempe,** Byte Shop #13 of Phoenix; **ARKANSAS: Fort Smith,** West Ark Computer Systems, (501) 646-3421; **CALIFORNIA, NORTHERN: Berkeley,** Byte Shop #10, (415) 845-6366; Kentucky Fried Computers, (415) 527-6760; **Campbell,** Byte Shop #3, (408) 377-4685; **Chico,** Micro-Byte, (916) 345-9396; **Citrus Heights,** Mike Anastasion, (916) 440-7216; **Daly City,** Action Audio Electronics, (415) 756-7440; **Davis,** Coyote Computers, (916) 752-2540; **Dublin,** Electric Brain Company, Inc. (415) 828-7480; **Fremont,** William Frick, (415) 792-9944; Casual Bedding, (415) 796-4555; **Hayward,** Computer Systems Unlimited, (415) 278-2667; **Morgan Hill,** Metatec Corporation, (408) 779-8150; **Mountain View,** Byte Shop #1, (415) 969-5464; Rebco, (415) 965-8581; **Oakland,** Robert H. Edmonds, (415) 834-3611; Pass Time Enterprises, (415) 654-5622; **Palo Alto,** Byte Shop #5, (415) 327-8080, Microprocessor Marketing, (415) 494-2011, **Sacramento,** Babylon Electronics, (916) 334-2161; **San Francisco,** Computer Store of San Francisco, (415) 431-0640; **San Jose,** Byte Shop, Incorporated, (408) 286-4545, Byte Shop #7, (408) 226-8383; **San Rafael,** Byte Shop #9, (415) 457-9311; **Santa Clara,** Byte Shop #2, (408) 249-4221; **Santa Cruz,** Byte Shop #6, (408) 425-1434; **Sunnyvale,** Edwin Hatch, (408) 245-4212; **Walnut Creek,** Byte Shop #11, (415) 933-6252; **CALIFORNIA, SOUTHERN: Costa Mesa,** Educational Properties Inst., (714) 642-9050; **Fullerton,** Bits 'n Bytes, (714) 525-9613; **Granada Hills,** Byte Shop of Tarzana, #17, (213) 678-0311; **Huntington Beach,** Byte Shop #14, (714) 549-9011; **Orange,** Computer Mart of Los Angeles, (714) 633-1222; **Pasadena,** Byte Shop #12, (213) 684-3311; San Diego, Computer Center, (714) 292-5302; **San Gabriel,** Sunny Sounds, (213) 287-1811; **San Luis Obispo,** Proko Electronics, (805) 544-5441; **Santa Barbara,** Channel Radio & Electronics, (805) 965-8551; **Upland,** Upland Computer Labs, (714) 981-1503; **Van Nuys,** Computer Components Inc., (213) 786-7411; **COLORADO: Boulder,** Inter-Mountain Digital, (303) 492-6061; **Denver,** Smith Systems Associates, (303) 744-6921; **CONNECTICUT: Cheshire,** JRV Corporation, (203) 771-4193; **West Haven,** Radio Communication Service, (203) 933-2432; **FLORIDA: Jacksonville,** Douglas Computer Systems, (904) 725-8158; **Miami,** Danco Electronics, (305) 235-0337; **Pinellas Park,** Elecon Corporation, (813) 541-3021; **St. Petersburg,** Offshore Marine & Electronics, (813) 345-3974; **Tampa,** Microcomputer Systems, Inc., (813) 879-4301; **GEORGIA: Atlanta,** Atlanta Computer Mart, (404) 455-0647; **HAWAII:** Chaminade College of Honolulu, (808) 732-1471; **ILLINOIS: Champaign,** The Numbers Racket, (217) 352-5435; **Chicago,** Bronson & Bratton, Inc., (312) 735-6200; **Cicero,** Digital Research Systems; **Evanston,** Itty Bitty Machine Company, (312) 328-6800; **Lake Forest,** Curtis Enterprises, (312) 234-5328; **Hazelcrest,** Quality Security Systems, Inc., (312) 799-7900; **Oakbrook,** Creative Electronics, (312) 887-7699; **INDIANA: Bloomington,** Data Domain, (812) 334-3607; **IOWA, Des Moines,** Midwest Computer Store, (515) 243-4032; **KENTUCKY: Lexington,** Wespro, (606) 278-2578; **Louisville,** Cybertronics, Inc., (502) 499-1551; **LOUISIANA: Baton Rouge,** Executone Microcomputer, (504) 927-7660; **MASSACHUSETTS: Boston,** American Used Computer Corp., (617) 261-1100; **Waltham,** Computer Mart, Inc., (617) 899-4540; **MARYLAND: Rockville,** Computer Workshop, Inc., (301) 468-0455; **MICHIGAN: Ann Arbor,** Compumart, Inc., (313) 994-4445; **Maybee,** Small Scale Systems, (313) 973-9311; **Oak Park,** Inatome & Associates, (313) 542-4862; **Troy,** General Computer Co., (313) 362-0022; **MINNESOTA: Eagar,** Byte Shop of Minnesota, #21; **St. Paul,** Microprogramming Inc., (612) 454-8857; **NEW HAMPSHIRE: Nashua,** Ronald Cordova, (603) 889-0691; **Union,** Computer Shop, (603) 473-2323; **NEW JERSEY: Colonia,** Computer Mart of New Jersey, (201) 574-2173; **Edison,** William Electronic Supply, (201) 985-3700; **Hoboken,** Hoboken Computer Works, (201) 420-1644; **NEW YORK: East Meadow,** Computer Mart, Long Island; **Fayetteville,** Computer Enterprises, (315) 637-6208; **Great Neck,** Computer Microsystems, (516) 829-9083; **Hollis,** Synchro Sound Enterprises, (212) 468-7067; **Ithaca,** Ithaca Audio, (607) 273-6401; **New York City,** Computer Mart of New York, (212) 279-1048; Audio Design Electronics, (212) 226-2038; **Oneonta,** Collegiate Audio, (607) 432-1930; **Water Mill,** John Rose Business Systems, (516) 726-4911; **White Plains,** The Computer Corner, (914) 949-DATA; **NORTH CAROLINA: Boone,** Joseph J. Howell, (704) 963-5816; **Raleigh,** Computer Associates, Inc., (919) 833-3012; **NORTH DAKOTA: Bismarck,** Kent Horne, (701) 258-2299; **OHIO: Columbus,** Data Systems; **Delaware,** Microworks Inc., (614) 881-5665; **Cleveland,** ELS Systems Engineering, (216) 321-8303/249-7820, **Cincinnati,** Scandinavian Handicraft, (513) 561-6785/281-6773; **Genoa,** Data Systems; **OREGON: Portland,** Byte Shop #4, (503) 223-3496; **Eugene,** The Real Oregon Computer Co., (503) 484-1040; **PENNSYLVANIA: Frazer,** Personal Computer Corporation, (215) 647-8460; **New Castle,** Lombardi Electronics, (412) 654-2235; **Philadelphia,** Byte Shop #18; Caldwell Computer Company, (215) 224-9133/224-9926; **Pittsburgh,** Martin J. O'Boyle & Associates, (412) 361-1602; **State College;** The Caravan, (814) 237-1392; **RHODE ISLAND: Warwick,** Computer Power Inc., (401) 738-4477; **TENNESSEE: Antioch,** Surya Corporation, (615) 794-0499; **TEXAS: Arlington,** Multi-Information Systems, (214) 748-9711; **Austin,** Austin Micro Products, (512) 446-2248; **Houston,** Electronic Specialty Company, (713) 333-2558; Polaris Computer Systems, (713) 527-0348; The Communication Centers, (713) 774-9526; **Pasadena,** Young Electronics Service, (713) 487-0446; **Richardson,** The Micro Store, (214) 231-1096; **So. Houston,** Computer Consultants, (713) 946-0456; **UTAH: Provo,** Computers & Stuff, (801) 377-1717; **Salt Lake City,** The Computer Room, (801) 466-7911; Computer Center, (801) 266-5906; **Sandy,** Micro Computer Systems, (801) 571-3263; **VIRGINIA: Blackburr,** Consolidated Services Corp., (703) 951-1031/951-9469; **Reston,** Media Reactions, Inc., (703) 471-9330; **Richmond,** Computer Hobbies Unlimited, (804) 276-5056; **WASHINGTON: Bellevue,** Byte Shop of King County #20; **Lacy,** Microcomputer Applications, (206) 456-3924; **Seattle,** The Retail Computer Store, (206) 524-4101; American Mercantile Co., (206) 624-6141; **Tacoma,** Computer Mart Tacoma, (206) 752-6565; **WEST VIRGINIA: Elkins,** Allegheny Computer Services, (304) 636-6600; **WISCONSIN: Beloit,** Austin Computer Company, (608) 365-6095; **Marinette,** Lauerman Department Store, (715) 735-3311; **Milwaukee,** The Milwaukee Computer Store, (414) 259-9140; **INTERNATIONAL: AUSTRALIA: Bankstown,** Automation Instrument Service; **Mulgrave,** Sontron Instruments, 560-0358; **CANADA: Brandon, Manitoba,** Canadian Microcomputer, (204) 725-1600; Dave Clark, (204) 727-2321; **Calgary,** The Computer Shop, (403) 243-0301; **Toronto,** Computermaster Systems, Ltd., (416) 924-9789; Trintronics Ltd., (416) 368-9539; John Crawford, (416) 487-7415; **Vancouver, BC.,** Richard Brown; **BELGIUM:** Janimex SPRL, 1180 Bruxelles; **ENGLAND: London,** The Entryphone Company, Ltd., London SW10; **ISRAEL:** Z. Melcer, Ltd., Haifa Bay, 26110; **MEXICO:** Ho De Mexico, S.A., Mexico 7, D.F.; Intelex, S.A., Mexico 18, D.F., Telex 017-72-514; **SWEDEN:** Hobby Data, 12 Malmo; **SWITZERLAND:** Bit Shop, Studer Electronic, 8006 Zurich; **TAIWAN:** Taipei, Sunshine Trading Company.

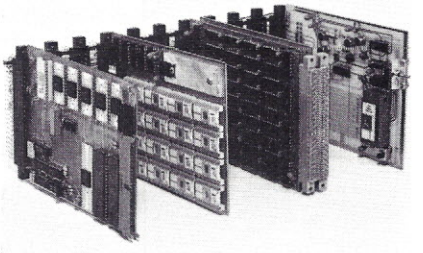
Join Our Growing Network of World-Wide Independent Dealers.

IMSAI

IMSAI Manufacturing Corp.

Wintek Reduces Micro Price 50% to $149, Announces FANTOM-II

Wide customer acceptance of its WINCE MICRO MODULES has allowed WINTEK Corporation to halve the price on its single card microcomputer. The price was reduced from $298 to $149 for the minimum configuration WINCE CONTROL MODULE consisting of a 6800 MPU, clock and baud rate generator, 1K ROM with FANTOM-II, 128 byte RAM, and ACIA (UART serial I/O) or PIA (16 TTL lines parallel I/O). The price for the maximum configuration module consisting of 6800 MPU, clock and baud rate generator, 1K ROM with FANTOM-II, 512 byte RAM, ACIA (UART serial I/O) and 2 PIA's (32 TTL lines parallel I/O) was reduced from $398 to $199. All WINCE modules (control, RAM, ROM, EROM programmer, A/D, etc.) are on industry standard 4½" x 6½" inch printed circuit boards.



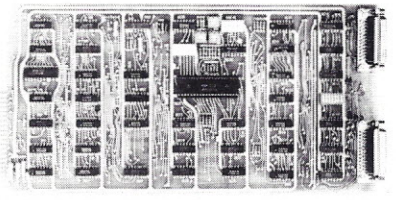
FANTOM-II is a new 1K monitor/debug program that allows single step execution of user programs, insertion and deletion of break points, and set up of interrupt vectors. It also allows the user to load memory, examine and/or change memory, print and/or punch memory, display MPU registers, go to user's programs, and reset.

For further information contact Wintek Corp., 902 N. 9th St., Lafayette, IN 47904, (317) 742-6802.

CIRCLE INQUIRY NO. 106

VADIC Adaptor Permits Automatic Dialing by Computer Via RS 232 Interface

An adaptor card, which enables a computer to initiate and transmit dialing information (digits and supervision) to a Bell or VADIC 801 type automatic dialer via the RS 232 modem interface, has been developed by VADIC.



Signaling takes place by characters sent from the computer on Transmit Data and received by the computer on Received Data.

The VA831 adaptor eliminates the need for an EIA RS366 dialer interface, which is not readily available on many computers, particularly smaller ones, and when available costs considerably more than the more common RS232 interface.

The VADIC VA831 makes automatic calling control possible through a multiplexer that does not pass 801 interface signals, which means an automatic dialer can be located at the distant end of a multiplexer link and accessed through a conventional RS232 interface without hardware modifications.

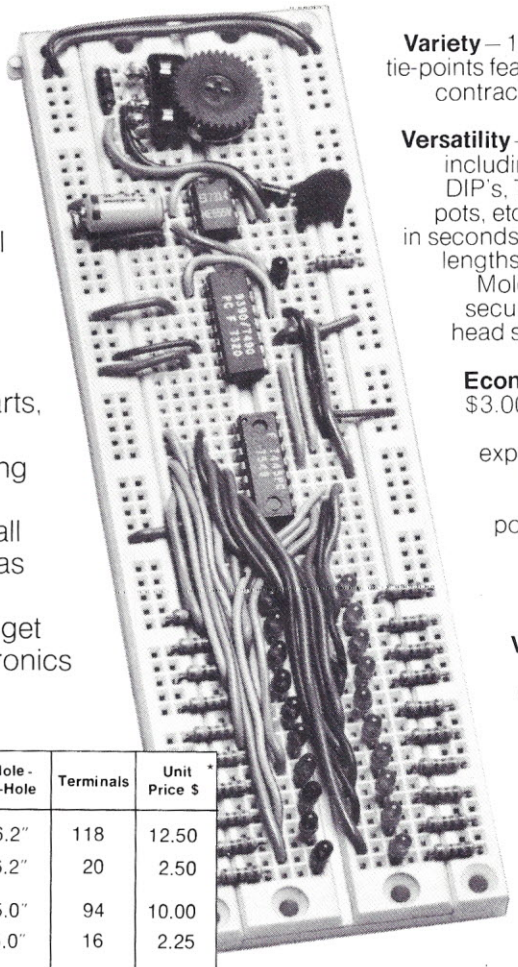
The VA831 adaptor card, which occupies a single slot in VADIC's VA1616 sixteen channel multiple data set chassis, is priced at $500 with delivery of 60 days ARO.

EVERY PROJECT IN THIS BOOK IS ANOTHER REASON TO OWN CSC'S QT SOCKETS AND BUS STRIPS.

With QT solderless breadboarding sockets and bus strips, you can build twice the projects in half the time. Because making connections or circuit changes is as fast as pushing in—or pulling out—component leads. No special clips or jumpers required, either.

When you're building circuits just for the fun of it, you can take them apart in minutes—not hours. So you save money by re-using parts, while eliminating heat damage to expensive components. Interlocking QT Sockets and Bus Strips are infinitely expandable, too: start small and "grow" breadboards as large as you wish.

For as little as $3.00, you can get a lot more out of your time in electronics—so why not treat yourself to a QT Socket today?



Variety—10 models from 70 to 590 solderless tie-points feature snap/lock design to expand or contract your breadboard to fit every circuit and budget requirement.

Versatility—Use with virtually all types of parts, including resistors, capacitors, transistors, DIP's, TO-5's, LED's, transformers, relays, pots, etc. Most plug-in directly and instantly, in seconds. No special jumpers required—just lengths of #22-30 AWG solid hookup wire. Molded-in holes let you mount QT units securely on any flat surface with 4-40 flat head screws, or 6-32 self-tapping screws, from behind panel.

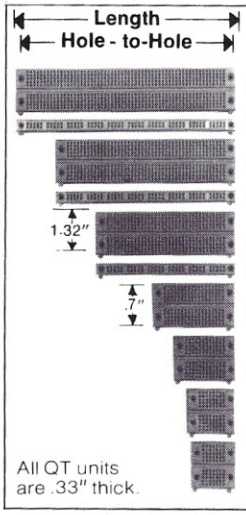
Economy—Sockets are priced as low as $3.00* Save more money by eliminating heat and mechanical damage to expensive parts, re-using components.

Speed—For fast circuit layouts, QT Sockets have 5 interconnecting tie-points per terminal; Bus Strips feature 2 separate rows of interconnecting terminals. Both connect and disconnect easily, without damage to socket or parts.

Visibility—All parts are instantly and easily visible and accessible, for quick signal tracing, circuit analysis and diagramming.

Durability—Higher-temperature sockets with abrasion-resistant, glass-filled plastic, rated better than 100°C. Screw-down-and-interlocked design provides high mechanical strength.

Reliability—Ruggedly designed to professional engineering standards, for heavy day-in, day-out use. Non-corrosive prestressed nickel-silver contacts insure more secure mechanical and electrical connections. Vinyl backing prevents shorting when mounted on conductive surfaces.



	Length	Hole-to-Hole	Terminals	Unit Price $*
QT-59S	6.5"	6.2"	118	12.50
QT-59B	6.5"	6.2"	20	2.50
QT-47S	5.3"	5.0"	94	10.00
QT-47B	5.3"	5.0"	16	2.25
QT-35S	4.1"	3.8"	70	8.50
QT-35B	4.1"	3.8"	12	2.00
QT-18S	2.4"	2.1"	36	4.75
QT-12S	1.8"	1.5"	24	3.75
QT-8S	1.4"	1.1"	16	3.25
QT-7S	1.3"	1.0"	14	3.00

CONTINENTAL SPECIALTIES CORPORATION

See your CSC dealer or call 203-624-3103 (East Coast) or 415-421-8872 (West Coast) major credit cards accepted.

44 Kendall Street, Box 1942
New Haven, CT 06509 • 203-624-3103 TWX: 710-465-1227
West Coast office: Box 7809, San Francisco, CA 94119 • 415-421-8872
TWX: 910-372-7992

*Manufacturer's suggested list • Prices and specifications subject to change without notice.

© 1976, Continental Specialties Corporation

CIRCLE INQUIRY NO. 39

COMPUTERISTS from Hawaii, Oregon, Arizona, New Mexico, Oklahoma and Texas join Californians in selecting A-Vid as their computer source. Why? *We ship faster!*

In stock for immediate delivery:

SWTPC Kits:

MP 6800 computer kit w/2k ram – still only **395.00**
Expand to 4k ram – MPMX .. **45.00**
Add another 4k ram – MPM/MPMX **125.00**
CT 1024 TV Typewriter with custom chassis **335.00**
AC-30 Audio Cassette Interface **79.50**
GT-61 Graphics Terminal **98.50**
PR-40 Printer **250.00**

Hot New Item for SWTPCO MP 6800:

16k Static Ram Board Assembled and tested. Low power and fast! Stuff 48k on board **595.00**
Personal Computing Prototype Boards
Small (I/O) **10.00**
Large (MPU) **20.00**
Connectors **50¢ ea.**

SWTPCO Software:

	Tape Mag	Paper
4 k Basic	**4.95**	**10.00**
8 k Basic	**9.95**	**20.00**
Editor Assembler	**14.95**	**14.95**

Midwest Scientific
12 k Basic **65.00**
Disassembler **25.00**
Icom Floppy **1895.00**
Lear Siegler ADM-3 24-line, 80 character TV terminal kit **875.00**
Oliver Paper Tape Reader kit **74.50**

All kits are available fully assembled, tested and guaranteed – ask for prices. Ask about the SWPTCO MP 6800 User Group.

A-VID electronics co.
SONY VIDEO PRODUCTS

1655 E. 28th
Long Beach
(213) 426-5526

New Hours:
Monday thru Wednesday 8 to 5
Thursday & Friday 8 to 9
Saturday 9 to 5

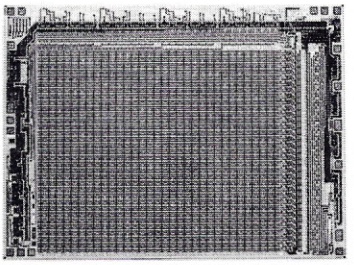
CIRCLE INQUIRY NO. 40

For further information contact Tom McShane, Vice President of Marketing, 505 East Middlefield Road, Mountain View, CA 94043, (415) 965-1620.

CIRCLE INQUIRY NO. 107

New Signetics 8K PROM Offers Higher Speed, 30% Size Reduction of Chip

A field programmable 8192-bit bipolar Read Only Memory with a 2048 X 4 organization is now available in production quantities from Signetics.



One of the first 8K PROMs to be marketed in large quantities, the new Signetics device also offers improvements in speed, size and power requirements over similar devices announced by other manufacturers, according to Ralph Kaplan, Marketing Manager for Memories.

The TTL-compatible memory is available with either Open Collector outputs (82S184) or Tri-State outputs (82S185), allowing for optimal word expansion in bussed organizations.

Key performance specifications include an address access time of 100 nanoseconds maximum and typical power dissipation of 50 microwatts/bit.

For further information contact Signetics, 811 East Arques Avenue, Sunnyvale, CA 94086, (408) 739-7700.

CIRCLE INQUIRY NO. 108

Compact Video Terminal Offers Low Cost

The CONVERSOR 8000 computer terminal features low cost ($695) and an 80 character wide x 24 line video display. Interconnection may be hardwired (RS232), or acoustically coupled (optional).



The CONVERSOR offers keyboard-selectable baud rate (110/300 standard), automatic scrolling, and is TTY compatible. It comes less monitor, with composite video output. Easily carried, the CONVERSOR measures just 6"H x 11"W x 14"D and weighs only 6½ lbs! Options: 1) 12" Monitor/TV . . . $120; 2) Built-in Acoustic Coupler . . . $110; 3) High Baud . . . (available soon); and 4) Beeper Package . . . $30.

For further information contact Computer Conversor Corporation, R. H. Kirschke (Manager), 1961 Old Middlefield Way, Mountain View, CA 94043, (415) 969-3213.

CIRCLE INQUIRY NO. 109

Intersil Introduces Low-Cost CMOS Tutorial System Implementing IM6100 Microprocessor Family

Intercept Jr., a new system developed by Intersil, Inc., Cupertino, California semiconductor manufacturer, is a low cost tutorial system utilizing Intersil's IM6100 CMOS microprocessor and its related family of CMOS devices.

The system provides students, hobbyists, and designers with practical, low cost exposure to microprocessors, RAMs PROMS and input/output interfacing.

Intercept Jr. recognizes the instruction set of Digital Equipment Corporation's PDP-8/E® minicomputer.

The basic Intercept Jr. module provides an operating all-CMOS microcomputer on a 10" x 11" double-sided PC board. It features a multi-function keyboard, two four-digit LED displays, a resident microinterpreter, and is battery powered.

A non-volatile CMOS RAM module provides convenient memory extension in the form of twelve IM6518 1024 x 1 CMOS RAMs

A power-strobed PROM module supplies up to 2k words of user program, on a 4½" x 6½" PC board.

A serial I/O module with both RS232 and 20mA current loop interfaces is also available.

The system comes fully assembled and factory tested, complete with batteries. Terminals are provided, enabling the system to run off an external 5 or 10 volt power source.

The owner's handbook details system operation, hardware description and basic programming techniques.

The Intercept Jr. module costs $281; the RAM module costs $145; the PROM module is $74.65; and the I/O module is $81.70. All modules are in stock for immediate delivery.

For further information contact Intersil Incorporated, 10900 North Tantau Ave., Cupertino, CA 95014; (408) 996-5000.

CIRCLE INQUIRY NO. 110

PC — 40 Lowest Priced 40-Pin Clip in Industry

Continental Specialties Corporation, New Haven, Connecticut has developed and is now marketing a new 40-pin IC Test Clip — Proto-Clip™ 40.

Patterned after Continental Specialties' other popular Proto-Clips: PC-14, PC-16, and PC-24; the PC-40 is compatible with .6" center IC's up to 40 pins. The PC-40 sells for only $13.75 — lowest priced 40-pin IC test clip made today.

This mini-troubleshooter offers a narrow throat; perfect for bringing IC leads up from high density printed circuit boards — practically eliminating accidental shorts while testing live circuits. It can be used to inject signals and wire unused circuits into other boards.

Scope probes and test leads lock onto the unique gripping contact teeth, freeing hands for other work. Non-corrosive nickel/silver contacts provide simultaneous wiping action, low low resistance connections to IC leads.

Overall plastic construction eliminates springs and pivots, while the unique molded web* insures thousands of operations.

The PC-40 is available immediately in bubble-packs, ready for display.

For further information contact Continental Specialties Corporation, 351 California St., Box 7809, San Francisco, CA 94119; (415) 421-8872.

CIRCLE INQUIRY NO. 111

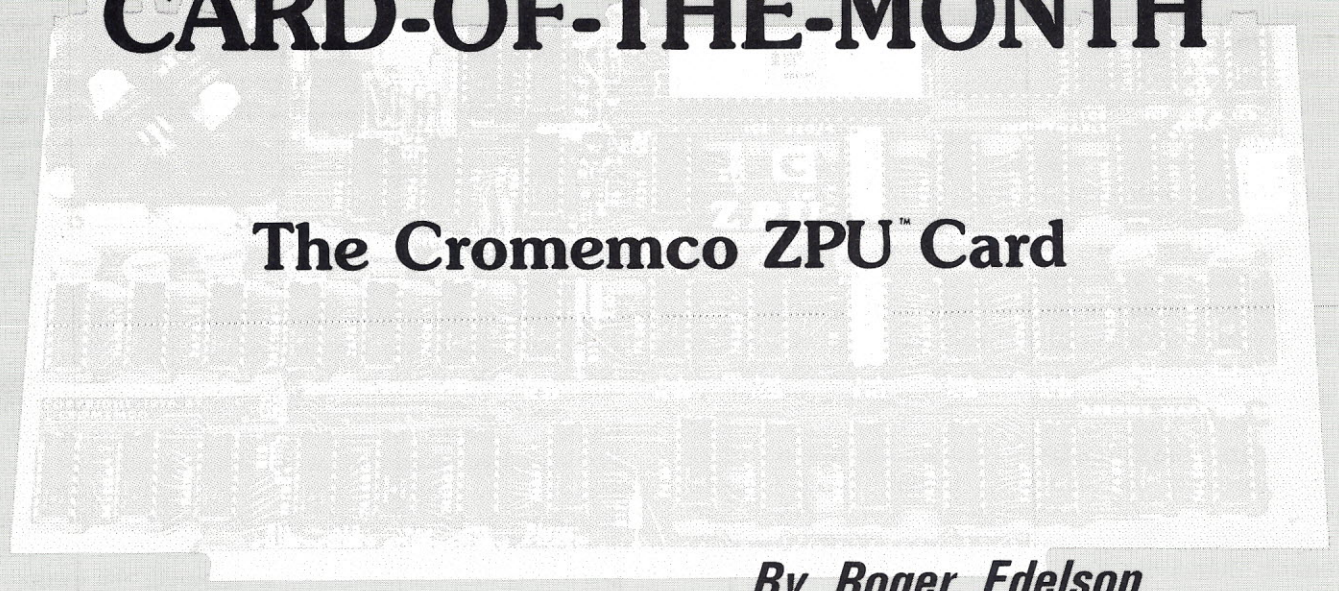
Inexpensive Enclosure Ideal For Protype CRT Units

Enclosure Dynamics, Inc. Model VTE 101 enclosure is molded of Noryl by a structural foam process. The enclosure is designed for a CRT terminal and consists of a base measuring 19" W, 21" D, and 4" high; a sloping front section for a keyboard, two ventilation grills, and a shroud with smoked-gray plexiglass screen.

For further information contact Enclosure Dynamics, Inc., P.O. Box 6276, Bridgewater, NJ 08807

CIRCLE INQUIRY NO. 112

CARD-OF-THE-MONTH



The Cromemco ZPU™ Card

By Roger Edelson

This is the beginning of what I hope will be a monthly article on a selected new card. If you readers have a card you're interested in please drop me a line, care of the publisher, and I'll try to do an article on it.

This month I'd like to cover the new release by Cromemco of their ZPU™ card. As you might have gathered from the name this is an MPU card utilizing the new Zilog Z-80 μ-computer. Before describing the ZPU card features lets take a mini-look at what the Z-80 gives you that the 8080A doesn't.

From a hardware standpoint, the Z-80 requires only a single voltage supply (+5V), a single phase TTL level clock from DC-3 MHz. All the pins are TTL compatable and dynamic RAM refresh circuitry is built-in. From the software side, the Z-80 is even more impressive. It features 158 instructions (including all the 78 machine code instructions of the 8080A), 17 internal registers and 10 addressing modes. Some of the specific extra instructions provide for single instruction memory transfers which are not available on the 8080A or the 6800. The Z80 also provides single instruction SET, RESET, on TEST of any bit in accumulator, any general purpose register, or any external memory location. Additionally the Z-80 provides single instruction BLOCK SEARCH of any desired length of external memory for any 8 bit character. Vectored interrupt and non-maskable interrupt capability is also provided. Sixteen bit arithmetic operations, increased rotate instructions, and a zero-page addressing capability round out this powerful chip.

Now that we have had a quick tour around the Z-80 chip, lets take a look at what Cromemco has done on their ZPU board. First, as the Z-80 and 8080 are not pin compatiible, the layout must be somewhat different than the Altair of IMSAI boards, the ZPU board is plug-in compatible with your ALTAIR or IMSAI system with the exception of the "STACK" signal. The ALTAIR/IMSAI front panel "STACK" light will indicate 2 or 4 MHZ operation.

The board itself is high quality with plated thru holes, gold plated edge connectors, high grade solder mask, and full silk screening. Sockets are provided for all IC's, and three resistor packs are used to reduce board space and speed assembly.

All lines are buffered using the ubiquitous 8197 to prevent static damage and provide system bus driving capability. Additionally, the Z-80 while normally wired to provide the standard 8080 Address Mirror function, can be set up to output all address bits. This mode, obtained by cutting a small piece of foil and adding a jumper, would remove the 8080-like characteristic of repeating the 8 bits specifying the address of an input, or output, port in both the low and high order 8 bits of the address bus. For customized situations this may be useful, but it is unlikely that you would require this option.

One very useful option is the provision for on-board switching from 2 MHZ to 4 MHZ. To switch from 2 MHz operation to 4 MHz operation simply flick the speed select switch on the ZPU from the 2 MHz to the 4 MHz position. Notice that the line previously labeled the "stack" line on the computer bus is now used as the 4 MHz indicator line. If you use the ZPU in an Altair or IMSAI computer your stack light will be on for 4

MHZ operation and off for 2 MHZ operation. (This indicator light is labeled "4 MHz" on the front panel of the Cromemco Z-1 computer.)

If the memory in your computer does not have a true access time of 250 nanoseconds or faster, wait states will be required for reliable operation at 4 MHz. If you use memory boards designed for 2 MHz operation, you will need to experiment with your particular memory boards to see how many wait states are required for reliable operation. Some memory boards require a single wait state on M1 cycles only. Slower boards may well require additional wait states. In any event, the on board wait state generator on the ZPU card greatly simplifies interfacing with your present memory at 4 MHz operation. And even with wait states, operation at 4 MHz will be very much faster than operation at 2 MHz.

Some interface boards are designed strictly for 2 MHz operation while others will work fine at 4 MHz. The Cromemco Dazzler for example works fine at either 2 MHz or 4 MHz operation with the ZPU card.

Serial interface boards that derive the UART clock signal from the Ø CLOCK signal (pin 49) of the S-100 bus generally will function properly with 4 MHz operation. (Ø CLOCK is defined to be a 2 MHz signal regardless of processor clock rate.) Serial interface boards that derive the UART clock signal from Ø2 will require modification for 4 MHz operation. The Processor Technology 3P+S interface, for example, works fine at 4 MHz following one foil modification to the pc board: simply sever the foil connecting to Ø2 (pin 24 of the edge connector) and jumper this foil instead to Ø CLOCK (pin 49 of the edge connector).

The ZPU features an on board wait state generator to insert optional wait states between the T2 and T3 cycles of each machine cycle. This is particularly useful if you desire 4 MHz processor speed using memory boards designed for slower 2 MHz operation.

If your memory boards have an access time of 500 nanoseconds or faster, they may be used without wait states at 2 MHz operation. If your memory boards have an access time of 250 nanoseconds or faster they may be used without wait states at 4 MHz operation. Even if no wait states are required the board is set up so that jumpers must be used to establish this condition, no real hardship. Also available is the option to select one additional wait state on M1 cycles only. This might allow marginal memory boards to function at the 4 MHz rate and still provide higher through-put.

While on the subject of memories, the ZPU provides automatic refresh capability. When using certain types of dynamic memory boards that require that the refresh address provided by the Z-80 is mirrored in the higher order address bits, a jumper wire should be installed between the pads labeled "RFSH ENAB." Normally no jumper wire is installed here.

One of the other nice features is the capability to have your computer jump to any 4K boundary in memory following reset. The address of the 4K boundary is selected by the four position slide-switch on the right side of the ZPU card. This option is enabled by installing a jumper wire connecting the two pins marked "jump enable" on the ZPU card. When the jump enable pins are connected together, a hardware jump instruction is automatically executed following a reset (the run switch of your computer must also be activated if it is in stop mode). To see how this works, be sure that the jump enable jumper in installed, press the stop switch on your computer front panel and then raise the reset switch. The number C3 (303 octal) should appear on the computer data lights. This is the op code of the hardware jump instruction. Now press the examine next switch on the front panel; all zeros will appear on the data lights indicating the low order 8 bits of the jump address. Now press the examine next switch again; the high order 8 bits of the jump address will now appear on the data lights. The low order four bits will indicate zeros. The high order four bits will correspond to the setting of the four position jump address switch.

To use the automatic jump feature, simply raise the reset switch and then the run switch. The computer will automatically jump to the location specified on the jump address switch. (If the computer is already in run mode only the reset switch need be activated).

Notice that the function of both the computer reset switch and the examine switch are affected when the automatic jump feature is enabled. Following reset the first instruction executed is not the instruction at location zero in memory, but rather is the instruction generated on the ZPU card causing a jump to the location specified by the jump address switch. After a reset (assuming that the computer is stopped) the examine switch must be activated twice in order to examine a memory location: once to clear the automatic jump and a second time to perform the actual examine operation.

The automatic jump feature is a very useful one. I have my ESP-1 Monitor program residing in PROM at EØØØ. The jump address switch is set so that the computer automatically jumps to the monitor following reset. To do this switch positions A15, A14, A13 on the jump address switch are set to the "1" position and A12 is set to the "0" position.

With regard to the circuitry, I have never been a great fan of the two gate approach to a clock oscillator but as it appears to work OK it does cut costs. Also, I dislike the use of selected value components. The ZPU board uses them to produce the delay required to obtain Ø2 clock. IMSAI uses a number of series connected gates to accomplish the same function - not a real good scheme either. I would prefer a real two phase clock generator circuit with flip-flops locked to the 8 MHz clock.

As far as construction goes - it was a snap. From start-to finish with time out for a cup of coffee it only took 1½ hrs. The solder mask is first rate (otherwise I would still be looking for shorts) and the silk screening generally very legible. I did have trouble placing the selected capacitors but that was mainly my fault, as I usually don't bother to read instructions. It would have been slightly helpful if a layout pictorial was included but the silk screening is done well enough to obviate the need. The components are intelligently separated and packaged making the assembly very easy. Sufficient by-pass capacitors appear to be present to eliminate TTL noise.

Included with the ZPU is a paper tape and listing of CROMEMCO's Z-1 Monitor. It extends from EØØØ to E3FF and requires 74 bytes of RAM storage. It includes executive commands to examine and change memory, make a binary or an ASCII dump of memory,

move and compare blocks of memory, output a byte of data to any port, read and write binary paper tapes, and program 2708 and 2704 proms using the CROMEMCO BYTESAVER.

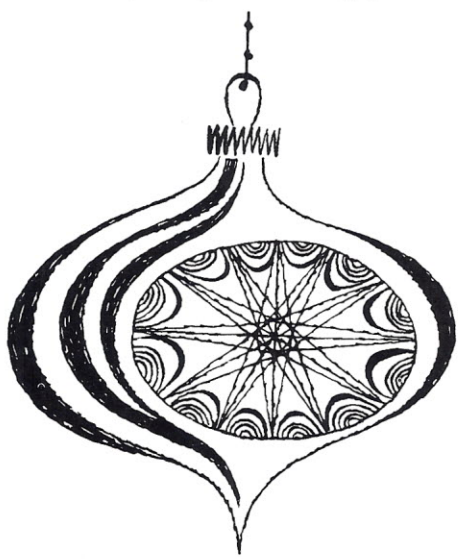
Transfer of control to a program in memory can be commanded from the keyboard with up to five breakpoints set and with the initial contents of the ZPU registers specified. When a breakpoint is encountered during execution, control is transferred back to the monitor and the contents of all 22 ZPU registers are stored and displayed. These register values can be examined and changed before execution of the program is resumed.

The Z-1 Monitor was designed to be flexible as well as powerful. For example, the monitor does not require the user to address a RAM board at a special place in memory for its own use. Rather, it finds the highest page of RAM active in the machine and places its stack and temporary storage area there. (The top 4AH or 74 bytes of this page should be reserved for system use.)

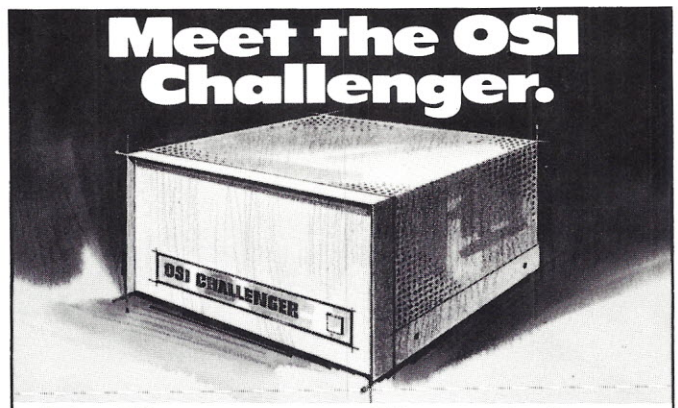
The monitor is also flexible in its command format. It will accept command words of any length, but it only looks at the first and last characters typed in. This allows the use of either longer expressions for their mnemonic value or shorter expressions for their brevity.

Also included is ZILOG's Z80-CPU technical manual, which is, in itself, quite complete and well-worth reading. With the exception the few very minor gripes noted before, this is an extremely well-thought out board providing the user with a considerable amount of flexibility and option convenience.

However, while I'm nit-picking, let's clear up one point: at this time ZILOG is not producing any part labeled Z80/4, so don't expect the Z80 on your ZPU board to be marked "Z80/4." What ZILOG will provide are sample and limited production quantities of Z80's selected for higher speed operation. CROMEMCO is buying these parts and selecting for 4MHZ operation. CROMEMCO is guaranteeing their ZPU board for the full 4MHZ operation, and will exchange any board that does not meet this specification. Since CROMEMCO will guarantee 4 MHz operation it does not really make any difference how they get there, and for $295 in kit form it provides a good way of increasing your ALTAIR/IMSAI capability and throughput.



Meet the OSI Challenger.



It offers more. It costs less.

No system is more complete. None is less expensive. OSI system boards and full documentation start at $29. Fully assembled systems at $439. And OSI offers more features than ever. Full multiprocessing capabilities. An innovative full color graphics and alphanumeric video system. New options for even greater system expansion. New software. And two of the best-priced floppy disk options you'll ever see. Now at your computer store or write OSI.

☐ Send me the free brochure on OSI kits and fully assembled computers.

☐ Send me the full line OSI catalog, $1.00 is enclosed.

OSI

Ohio Scientific Instruments
11679 Hayden Street Hiram, Ohio 44234 (216) 569-7945

CIRCLE INQUIRY NO. 41

★ ★



★ ★

The completely assembled and tested MP-40 printers continue to be the favorite of commercial users and hobbyists alike. Featuring a 5X7 impact dot matrix, 40 columns, 75 lines per minute, 4" adding machine paper, molded casework, zinc-plated chassis and power supply. Choose from one of these three interface models.

• **LCP**	• 8-bit Parallel I/F without character generator for special software fonts	**$329**
• **ASCII**	• 8-bit Parallel Interface with a 64 character ASCII set	**$425**
• **SSP**	• Intelligent RS232 or Current Loop data terminal. Async Serial I/F	**$575**

OR SELECT THE "NO FRILLS" KP-40 KIT

• Mechanism, LCP I/F PC board & components Power transformer and assembly instructions **$179**

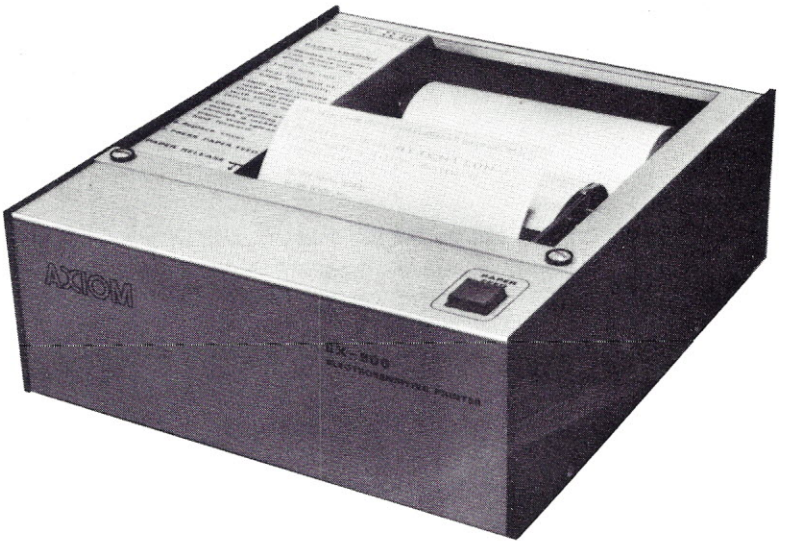
SEND FOR FREE LITERATURE

Master Charge Welcome • Utah Residents Add 5% Sales Tax

mpi/P.O. BOX 22101/SALT LAKE CITY/UT/84122
(801) 566-0201

CIRCLE INQUIRY NO. 42

The Hardcopy Revolution



By Simon Harrison
Axiom Corporation, Pasadena, Ca

Everyone has been waiting for the $500.00 full-format line printer. But will it ever happen? Why hasn't it happened already? This article attempts to answer these questions and also to predict where the scramble for this multimillion dollar market will end.

WHAT IS SO MAGICAL ABOUT A $500.00 LINE PRINTER?

Of course there are a number of line printers on the market that sell for less than $500.00. While these represent excellent dollar value, their performance excludes them from almost all systems applications. Existing peripherals and software are irrevocably locked into the 80-column format and this must be a minimum requirement for a serious contender in the hardcopy race.

The other main performance requirement is printing speed. Most systems transmit data in serial format at fixed baud rates. Except where teletypes are involved, 110 baud is too slow and, at the other end of the scale, 9600 baud is too fast for a lot of peripherals and requires extra buffer storage to be made available to smooth out incompatibilities. The universal compromise is 1200 or 1800 baud which requires a printer with continuous throughput capability of between 120 and 180 characters per second.

When specifying the speed of a printer, parameters like "maximum data acceptance rate" and "single line printing speed" are often quoted, but can be extremely misleading. Obviously an input buffer can be loaded very quickly, but as soon as it is full the printer interface will give a Receiver OverRun (ROR) signal which must be used to inhibit further transmission, otherwise data will be lost. Once the buffer has been filled it is emptied at the same speed as characters are printed out, in other words, at the "throughput" speed, which is by far the most useful measure of relative printer performance. This is especially true when you consider that the most common usage of the RS232C serial interface involves connecting only two wires, (signal and ground) so that ROR is not monitored and it becomes essential to use a printer which has a genuine throughput speed equal to the data transmission rate if no data is to be lost. For example, to match a 1200 baud transmission, a throughput speed of at least 120 characters per second is required.

These performance requirements are epitomized in the Centronics 306 which is an excellent general-purpose line printer giving 80-column printout at 120 characters per second. This printer has a lot of other features like the ability to handle forms and make multiple copies that puts it way out of the $500.00 price bracket. Nevertheless when we talk about the $500.00 line printer, this level of performance will need to be achieved before any revolutions are started!

Why the $500.00 figure? Obviously this is not an exact amount but it is related to the cost of other peripheral and data processing equipment. In any system, hardcopy is an optional extra. There are always less expensive ways of displaying information, but anyone who has a TV monitor without a printer will at some point be frustrated at not being able to transfer completed data from the screen to permanent hardcopy. The annual market for CRT terminals in excess of 500,000 units, and every single one of them is basically deficient without a printer. Why? Because a CRT terminal costs $700-$800 in large quantities whereas a medium speed line printer usually costs around $1500 $2000 in similar quantities. The numbers just don't match. At $500.00 a printer becomes a much more realistic "option."

The same argument holds true for today's low-cost microcomputers. Whether at home or at work, who wants to pay even $1500.00 for a line printer when a MITS 8800b costs less than $1000.00.

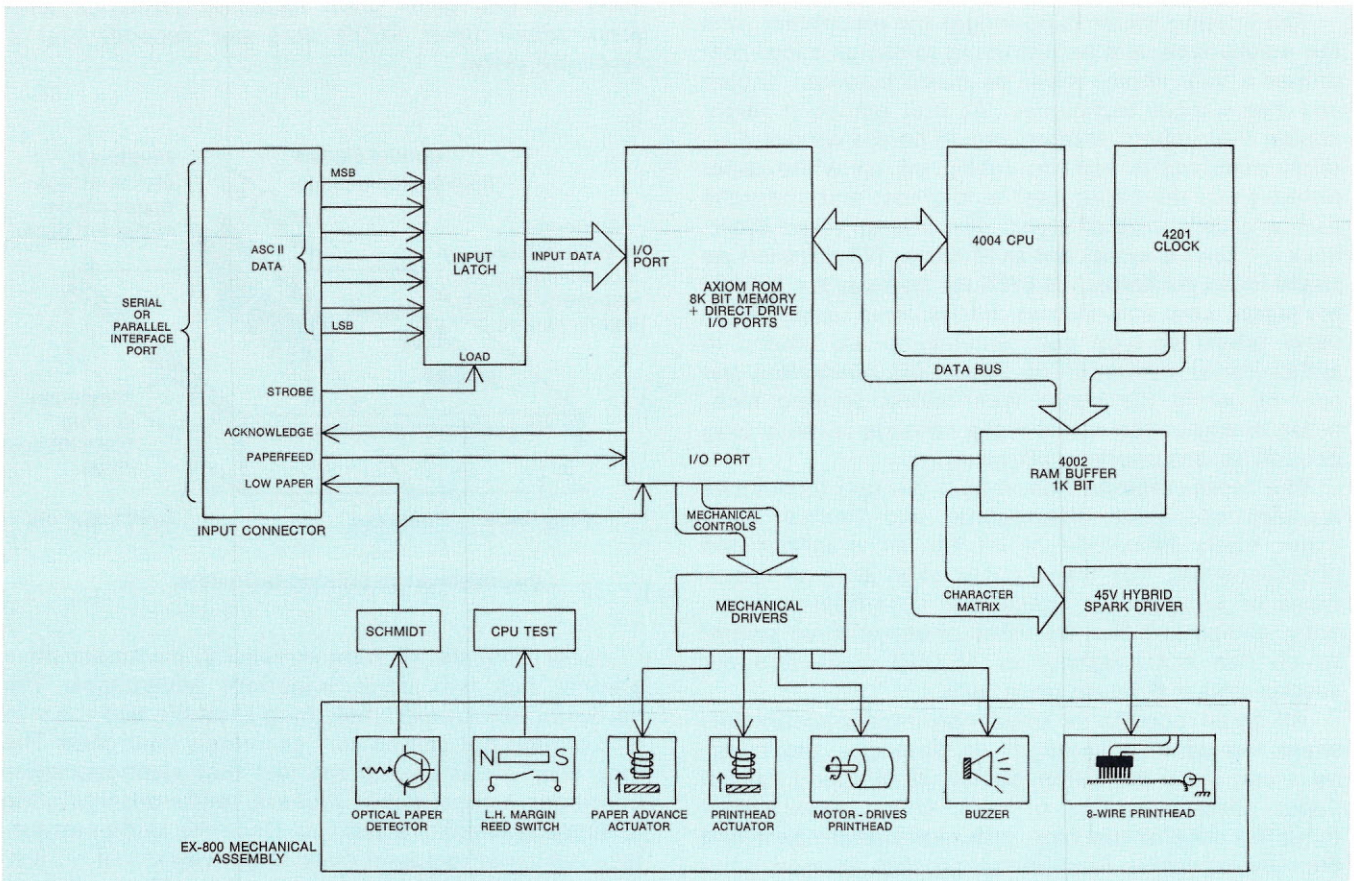
There are new requirements for low-cost printers in other areas as well — a good example is the instrumentation field. In the old days, you used a DVM (digital voltmeter) to measure a voltage, copied down the reading, and that was that. One voltage gave one reading. But now there is a microprocessor in there somewhere handling time-averages, peak readings, nomalisation — all the things you used to sit down and work out afterwards. Suddenly, there is no such thing as a simple "reading." DATA has been created. Data means hardcopy, and although few instruments require 80-column alphanumeric printing, this is only because of the cost of printers. "Intelligent" instruments have plenty of processing power waiting to be utilized when printer technology catches up with the electronics.

WHY HASN'T IT HAPPENED ALREADY?

Anyone who is waiting for a Grand Entry will be disappointed. There has been a gradual opening of the market which will certainly continue. THe same low-cost microprocessors which generated the need for low-cost hardcopy make it possible to produce versatile interface electronics at a fraction of the cost of traditional designs. Of course, it is not all a bed of roses, the printer manufacturer is faced with making a significant commitment to a large IC manufacturer to custom-mask one of the really cost-effective LSI devices which contain ROM, I/O and interfacing on a single chip. The following electrosensitive printer by Axiom is a good example of a hard copy printer meeting the above requirements;

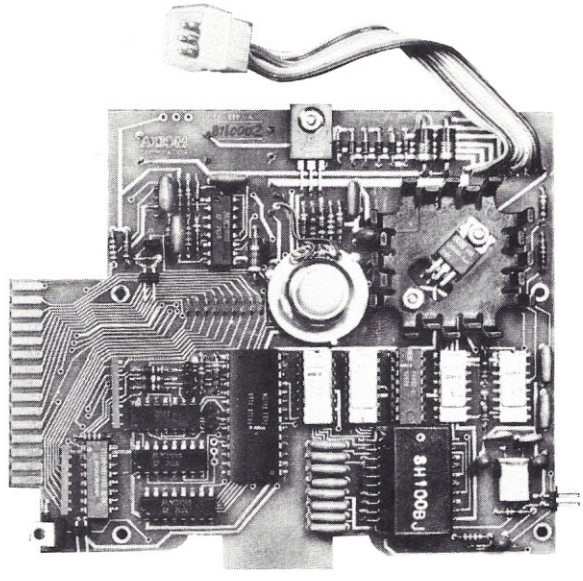
"High density control electronics. The complete interface package for the EX-800 printer is squeezed onto a 5 inch square card."

As an example of how the new technologies have increased the density of electronic control circuitry, the complete electronic package of the new Axiom EX-800 printer uses hybrid and LSI components and squeezes a 4004 microprocessor, 8K ROM, IK Ram, 29 I/O lines, 4 level power supply, low-paper detector, buzzer, printhead driver and input protection circuit onto a board only 5 inches square. The interface for the Ex-800 printer is shown in the following functional diagram;



AXIOM EX-800 PRINTER FUNCTIONAL BLOCK DIAGRAM

Such economies mean that the cost of the electronics does not stand significantly in the way of a $500.00 price tag.



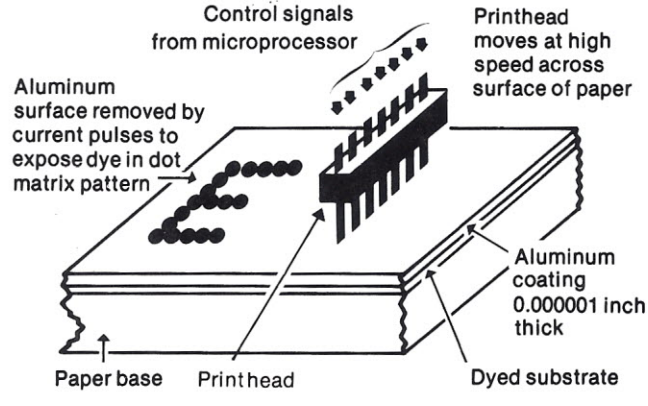
The limiting factor is no longer the electronics, it is the mechanism, and before trying to design a low-cost printer a vital choice must be made between impact and non-impact techniques. At first glance it might appear that impact printing should be the winner. Certainly everyone is used to seeing ink on white paper printout and the paper itself is low cost and offers the user a wide choice of styles. There is only one drawback — **there is no way that an 80-column 120 characters per second impact mechanism will EVER see the inside of a $500.00 line printer.** Low cost impact mechanisms (using drum, daisy wheel or type belt techniques) are limited in speed to a maximum of about 50 characters per second, while the faster wire matrix printing technique becomes too costly if the carriage is made long enough to accomodate 80 columns.

The most common non-impact printing techniques are electrosensitive, electrostatic, and thermal. More exotic methods include ink-jet, hot air, magnetic and photosensitive, but these either exist only as prototypes or are used in specialized ultra-high-performance equipment like the IBM photosensitive printer which has a throughput of 45,000 characters per second and a 6 figure price tag!

All three commonly used non-impact techniques share the same advantages of simplicity and quietness and carry the same burden of requiring special paper. Electrosensitive printers, which work something like a Xerox machine, give high-performance and are very expensive. The thermal process, as used in the Texas Instruments 700 series, prints on treated paper which has the advantage of looking like ordinary paper but is limited in speed to about 30 cps due to the time required to form an image. This leaves the electrosensitive process, which is one of the fastest growing areas of printer technology. It represents the simplest known method of marking paper at high speed and the advances in electrosensitive technology over the last 12 months have been phenomenal.

WHY ELECTROSENSITIVE PRINTING?

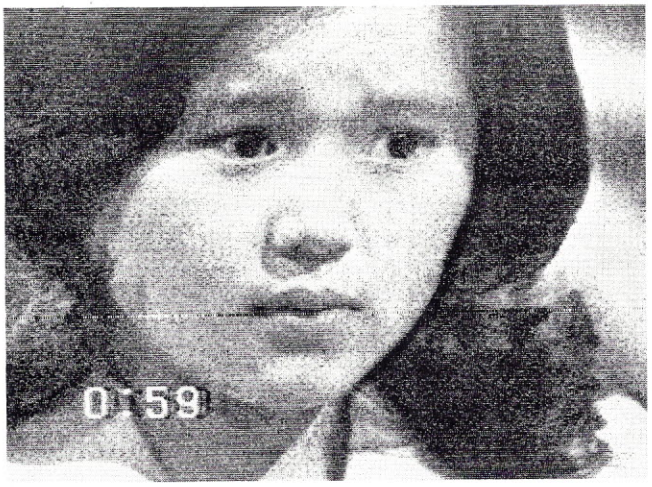
The electrosensitive printing technique has two major advantages — speed and simplicity. Electrosensitive paper has an aluminum surface coating approximately one millionth of an inch thick over a layer of ink or dye. An image is formed by passing a current into the aluminum surface from a wire electrode which is lightly in contact with the paper. Within as short a time as 50 microseconds (depending on the voltage applied) the aluminum coating is vaporized, exposing the dark surface underneath which is seen as a mark. The size of the printed mark may be varied by changing the duration of the current pulse or the applied voltage. Obviously, it is far simpler to vary the duration of the pulse, but for maximum resolution (as required in a facsimile machine) it is better to use a very short pulse cycle and alter the applied voltage on the printing electrodes. The picture of the Japanese girl was produced in this way on a simple low-cost electrosensitive mechanism with 350 printing wires in line across the paper, at an output speed in excess of 700,000 dots per second. It takes a fair amount of storage space and specialized interfacing to support this kind of performance, but the printing technique itself could hardly be any simpler. The new MITS 7000 printer/plotter puts the electrosensitive technique to good use and gives great flexibility combined with good speed (over 8000 dots per second) and a moderate price.



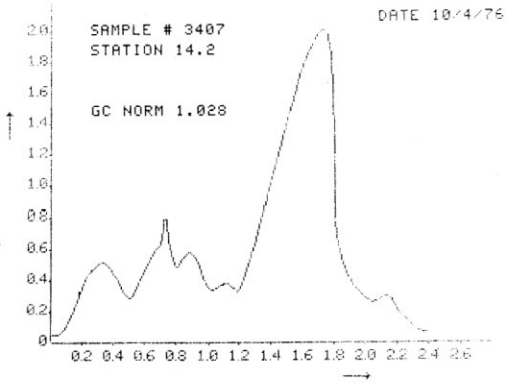
"Electrosensitive printing technique."

Apart from its inherent simplicity, electrosensitive printing has two other important advantages. The hardcopy has an extremely long shelf-life and the size of a printed dot can be very accurately controlled. The long shelf-life is due to the fact that electrosensitive printing is a substractive process, unlike other printing techniques which are additive. Once the aluminum surface has been removed there is no way to put it back, and the resulting hardcopy is unaffected by heat, sunlight or moisture.

The high resolution of the electrosensitive process is probably its most significant feature, for it means that characters can be printed smaller without losing readability. The standard print size in a paperback book is around 17 or 18 characters per inch and is perfectly legible, but an impact printer which has a ribbon (a typewriter is a good example) cannot print this small



"This facsimile took about ½ a second to produce on a simple electrosensitive mechanism."

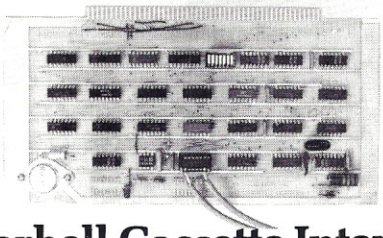


"Hardcopy output from the MITS 7000 printer/plotter."

without smudging. The thickness of the ribbon and the diffusion of the ink prevent clear separation of closely spaced images. Electrosensitive printing does not suffer from this limitation. The size of a dot can be precisely controlled by timing the duration of the current pulse to within a few microseconds. A microprocessor gives almost infinite flexibility, allowing character sizes to be changed simply by varying the cycle time for printing a dot.

The printout sample on this page shows the hardcopy from Axiom's new EX-800 printer which is perfectly readable at just over 18 characters to the inch.

Now that higher print densities can be realistically achieved, there is no need to have an 8½ inch wide platen for 80-column printout. Since the cost of a basic printer mechanism increases rapidly with the width of the platen, any reduction in width will have a significant effect on the price of the end product. Five inch wide paper costs less than 8½ inch wide paper and this almost completely offsets the higher cost of electrosensitive paper. Depending on the volume of paper used, the MITS 7000 or the EX-800 printer can produce a page of 80-column printout equivalent to an 8½ x 11 inch sheet for between 0.6 and 1.2 cents.



The Tarbell Cassette Interface

- Plugs directly into your IMSAI or ALTAIR
- Fastest transfer rate: 187 (standard) to 540 bytes/second
- Extremely Reliable—Phase encoded (self-clocking)
- 4 Extra Status Lines, 4 Extra Control Lines
- 25-page manual included
- Device Code Selectable by DIP-switch
- Capable of Generating BYTE/LANCASTER tapes also.
- No modification required on audio cassette recorder
- Complete kit $120, Assembled $175, Manual $4

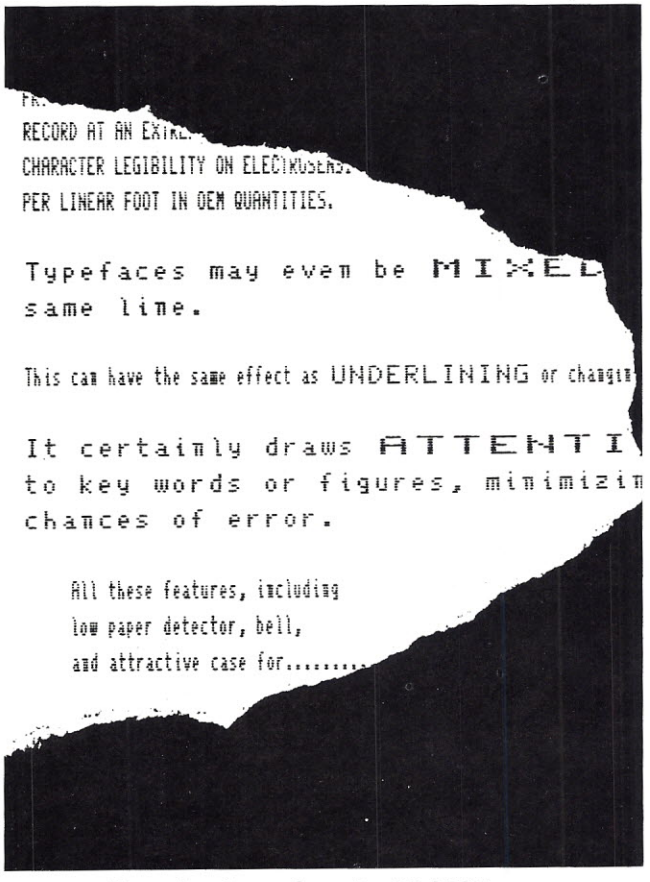
TARBELL ELECTRONICS

144 Miraleste Drive #106, Miraleste, Calif. 90732

(213) 538-4251

California residents please add 6% sales tax

CIRCLE INQUIRY NO. 43



"Sample printout from the EX-800."

TAKE ADVANTAGE OF US!

DON'T DUMP YOUR MONEY INTO THE MAILBOX—
THEN SIT AROUND AND WAIT!!

DON'T BUY FROM WANDERING MERCHANTS
WHO WON'T BE THERE WHEN YOU NEED THEM!!

A COMPUTER MART IS A PLACE WHERE THEY CARE
ABOUT YOU — AND YOUR COMPUTER EQUIPMENT.

WE SELL THE BEST LINES, AT REASONABLE PRICES.
THAT'S HOW WE MAKE OUR LIVING.

WE HELP YOU GET YOUR SYSTEM UP AND RUNNING.
WE WILL BE HERE TOMORROW
AND THE NEXT DAY!

LEASING ARRANGEMENTS NOW AVAILABLE.

THE COMPUTER MART

NEW YORK
314 Fifth Avenue,
New York, N.Y. 10001
(212) 279-1048
Between 32nd and 31st
Two blocks from the
Empire State Building

LONG ISLAND
2072 Front Street
East Meadow, L.I.,
New York,11554
(516) 794-0510
Near Hempstead
Turnpike

IMSAI, PROCESSOR TECHNOLOGY, SOUTHWEST TECHNICAL PRODUCTS, OSI, SEALS ELECTRONICS, DIGITAL GROUP, APPLE COMPUTERS, TARBELL, OLIVER, CROMEMCO, TDL, CONTINENTAL SPECIALITIES, VECTOR, GBC VIDEO MONITORS, BOOKS, MAGAZINES, CHIPS, SOCKETS, CONNECTORS. . . AND ALL THAT GOOD STUFF.

CIRCLE INQUIRY NO. 44

Sunny Sounds has the
IMSAI-8080
and other IMS products



For further info call or write:

Sunny Sounds

1 - 7 Monday thru Saturday
Closed on Sundays

927-B East Las Tunas
San Gabriel, CA 91776
Phone: (213) 287-1811

CIRCLE INQUIRY NO. 45

WHY DOESN'T EVERYONE USE ELECTROSENSITIVE PRINTERS?

There are obvious limitations. Lack of multiple copies is certainly one. Most other complaints boil down to the paper itself. Silvery appearance, low contrast and susceptibility to fingerprints have all been drawbacks in the past. Nowadays, a lot more is understood about the manufacture of electrosensitive paper and these problems have all been linked together and have to a large extent already been overcome.

The surface appearance of the paper depends mainly on the composition of the dark layer beneath it. If this is an ordinary ink, then outgassing occurs when the aluminum surface is vacuum deposited, causing minute bubbles to be formed in the aluminum. This micro-roughness gives the paper an attractive matt finish close in appearance to white paper and increases the contrast of the printout. Unfortunately, these same surface irregularities absorb the oils present in skin causing the paper to show fingerprints. This problem can be avoided by using a non-volatile dye as the dark base which does not interfere with the deposition of the aluminum, leaving the surface smooth and impervious to fingerprints. The drawback here is that the smooth finish has a silvery appearance with reduced contrast.

Somewhere between these two limits is the right combination, and with the way the technology is progressing it is true to say, "If you haven't seen electrosensitive printing recently, you haven't seen electrosensitive printing." The following DIV 16 6800 Microcomputer program submitted by Motorola and listed vie the Axiom 800 printer is a good example of today's electrosensitive printing process.

THE FUTURE?

Look around. There are printing calculators, facsimile machines, high and low speed line printers, plotters and mailing label printers all using the electrosensitive technique. Electrosensitive paper is produced with form overlays, adhesive backing and can print in any color. Complex characters like OCR and bar codes can easily be printed at high speed, making the technique ideal for automatic labelling and ticketing machines. Wherever low-cost hardcopy is required electrosensitive printers are finding a place.

The hardcopy revolution may be over before it began. The Axiom EX-800 electrosensitive printer costs $595.00 complete.



Software Section

By Robert A. Stevens
Software Editor

SOFTWARE SECTION THIRD STEP

INTERFACE AGE takes the third step forward in filling the Microcomputer software void. This issue includes 8 articles on software which include 5 major software development program source listings, one hardware diagnostic program source listing and one subroutine source listing. In addition, INTERFACE AGE introduces the best article of the year award to encourage prospective authors to submit their hardware/software articles, to INTERFACE AGE for publication.

Three BASIC Interpreters, two on Tiny BASIC and one on standard BASIC provide conversational language programming software development capabilities for the 8080 and SC/MP based microcomputers. Dr. Wang's Palo Alto Tiny BASIC by Roger Rauskold and LLL's BASIC Interpreter by John Dickenson, Jerry Barber and others provide conversational language program development for the 8080 while National's Tiny BASIC Interpreter NIBL provides conversational language program development for the SC/MP. As an added bonus the complete assembly listing of Dr. Wang's Palo Alto Tiny BASIC Interpreter is published and will be available with object code in punched paper tape through the Microcomputer Software Depository. Assembly listings for the other two Interpreters will be published in next month's issue of INTERFACE AGE.

A Text Editor program by Mark Borgerson provides word processing application-oriented type of text editoring for the 6800 based Microcomputers.

A MICRO BASIC Relative Address program by J. Huffman provides additional BASIC programming power that can be added to your TB (Tiny BASIC), TBX (Tiny BASIC Extended), or standard BASIC Interpreter for the 6800 based Microcomputers.

A memory hardware diagnostic program by T. W. Travis for the 8080 should help keep your 8080 Microcomputer up and running.

A new resident 8080 software package CONSOLE developed by Processor Technology provides a resident software operating system for their new single PCB intelligent Microcomputer Terminal called SOL Terminal Computer. The complete CONSOL assembly listing is published in this issue.

A new 8080 resident compiler by INTEL is summarized in this issue for the OEM readers.

BEST ARTICLE OF THE YEAR AWARD

INTERFACE AGE will bestow an Honorary Award of $500 value in products advertized in INTERFACE AGE to the author of the best non-commercial Microcomputer article published during the year ending November 1977. The best article of the year award will be picked from the group of the best article of the month awards. Like the best article of the month award, only individuals are eligible for this yearly honorarium. The yearly award is in addition to the monthly award and honorarium given on the page count basis. The yearly award will be judged by the editors of INTERFACE AGE and will be announced in February 1978 issue of INTERFACE AGE.

BEST ARTICLE OF THE MONTH AWARD UP-DATE

Starting in this issue, INTERFACE AGE will bestow an Honorary Award of $100.00 to the author of the best non-commercial Microcomputer article of the month. Only individuals are eligible for this monthly honorarium. This monthly award is in addition to the honorarium given on the page count basis. Microcomputer articles may be on hardware, software or a combination hardware-software and will be judged by the INTERFACE AGE readership. Each INTERFACE AGE magazine shall include one original bingo voting card. Each individual possessing a bingo voting card shall be allowed up to ten votes to be cast as a total single vote block for one author or subdivided into any vote block segment size combinations, with the total cast vote sum not to exceed ten, cast between two or more authors (no xerox copies of the bingo vote card please). Each published article is assigned a block of 10 bingo card numbers with the last digit of the number (LSD) to represent your cast vote value. 0 represents a vote value of 10. The prefix digits of the number block defines the article number. The following is an example of voting for two articles with a voting value of 7 for article number 17 and 3 for article number 19;

All valid bingo vote cards must be postmarked prior to 12:00 P.M. of the last day of the month following the issue date of the related magazine.

SEE EXAMPLE NEXT PAGE

Example

171	172	173	174	175	176	177	178	179	180	←Article # 17
181	182	183	184	185	186	187	188	189	190	←Article # 18
191	192	193	194	195	196	197	198	199	200	←Article # 19

INTERFACE AGE WILL PAY UP TO $50/PAGE FOR SOFTWARE

INTERFACE AGE is continually soliciting original unpublished quality documented highly commentated source/object code software listings and software technical articles for publishing in the INTERFACE AGE. Manuscript text must be typed double spaced with wide margins. Figures, tables, flow diagrams and charts must be numbered and submitted on separate sheets of white bond paper (Send Original copy only). Program listings must be printed on white clean paper using a new black ink ribbon, and please, if possible, supply a punched paper tape assembly (source+object) code listing + source code listing + object code dump with your hard copy. Be sure to record your name, company and office and home telephone numbers on all materials submitted to the software editor. Also include statement in cover letter allowing INTERFACE AGE and the Microcomputer Software Depository to publish and distribute copies of your software program. Include a prepaid postage stamped envelope with your return address only if you want your manuscript returned, in the event that the submitted article is not accepted for publication.

Articles accepted and published will receive an honorary recognition award. Honorariums are based upon technical content, manuscript preparation and subject suitability for publication in INTERFACE AGE. Honorariums range from $15.00 to $50.00 per unreducted typeset magazine page. In addition, starting with this issue, the best article of the month submitted will receive a $100 bonus. INTERFACE AGE'S readership will determine by vote which is the best article. (See best article of the month award). All software submitted to INTERFACE AGE will be deposited in the Microcomputer Software Depository (MDS) for low cost distribution.

Address all software correspondence to R. A. Stevens, Software Editor, c/o INTERFACE AGE Magazine, 2361 E. Foothill Blvd., Pasadena, CA. 91107 or call (213) 449-1655.

SOFTWARE SHOPPING LIST

Now that INTERFACE AGE has expanded the Microcomputer software coverage and developed a large appetite for good software, your programs and application software is badly needed to quench this enlarged software appetite. This software shopping list includes the following:

- **Microcomputer Development Software** such as assemblers, disassemblers, editors, monitors, utilities, mini-maxi BASIC interpreters & compilers, FORTRAN interpreters & compilers, boot strap loaders, software drivers, cassette software operating systems (COS), floppy disc software operating systems (FDOS), TTY software operating systems (TTYOS), and CRT software operating systems (CRTOS) for all Microcomputer configurations.
- **Short Software Routines** such as math packages and I/O diagnostics for all Microcomputer configurations.

NEW COMPUTER STORE!!!
COMPUTABLE PRICES!!!

COMPUTE THIS!!!

A PACKAGE DEAL
APPLE 1 Computer (with 4K RAM). . . .
. regularly $666.66
Additional 4K RAM . .regularly 120.00
Cassette Interface regularly 75.00
—ALSO—
Sanyo 9" Video Monitor.
. regularly 185.00
Datanetics ASCII Keyboard
. regularly 100.00
ALL FOR $999.00
All this regularly sells for. $1146.66
YOU SAVE $147.00!

FOR MORE INFORMATION, CONTACT:
Sunshine
COMPUTER CO
9 PALOMINO LANE
CARSON, CALIF 90745
Phone:(213) 830-8965
RICH TRAVIS
We also offer a full & complete mail order service for those of you who are outside the immediate area!
CIRCLE INQUIRY NO. 46

- **Application Software Programs** such as Analog To Digital Converter (DAC) - Digital to Analog Converter (DAC) software control programs, Automated membership billing and mailing list update program, Inventory control software, invoice and billing software, Accounts Receivables and Payable software, process control programs, etc. for all Microcomputer configurations.
- **Software Communications Protocol Programs** for such communication protocols as the BSC or Bisync (Binary Synchronous communications protocol procedures) and the new SDLC (Synchronous Data Link Control communication protocol procedures), etc.
- **Off-line Software Storage Format Control Programs** for cassette, paper tape, and floppy disc software recording formats.
- **Microcomputer Game Programs**
- **Add Your Own Program Shopping List Here.** Send your list to the software editor.

HALF SIZE PROGRAM LISTINGS VERSUS LESS PROGRAMS

For this issue INTERFACE AGE was faced with a difficult decision between providing a large amount of software and printing the program source listings at half size or reducing the amount of software published and printing the source listings at near full size. Normally INTERFACE AGE would like to print all program source listings near full size with the full knowledge from experience that easy to read program listings are as important to the programmer as reference material as good logic or schematic diagrams are to the logic and circuit designers. The problem developed in the process of receiving more software than could be published at normal size in the next two or three months. As evidenced by the half size printed listings, INTERFACE AGE chose this approach as a means to providing more software to the reader in the shortest interval of time. INTERFACE AGE will also print next month's program listings at half size for the same reasons. As a consequence of publishing program listings at half size, it is hoped that our readership will provide feedback comments on this subject to help form our future publication goals. Please address all your comments to the Software Editor.

INTERFACE AGE NEEDS YOUR VOTE

Help INTERFACE AGE determine the type of articles you want to see published in the future by casting your vote of 10 points for the article or articles (by vote splitting) you liked best. Feedback will provide encouragement to authors and will help make the INTERFACE AGE The Microcomputer magazine of the industry.

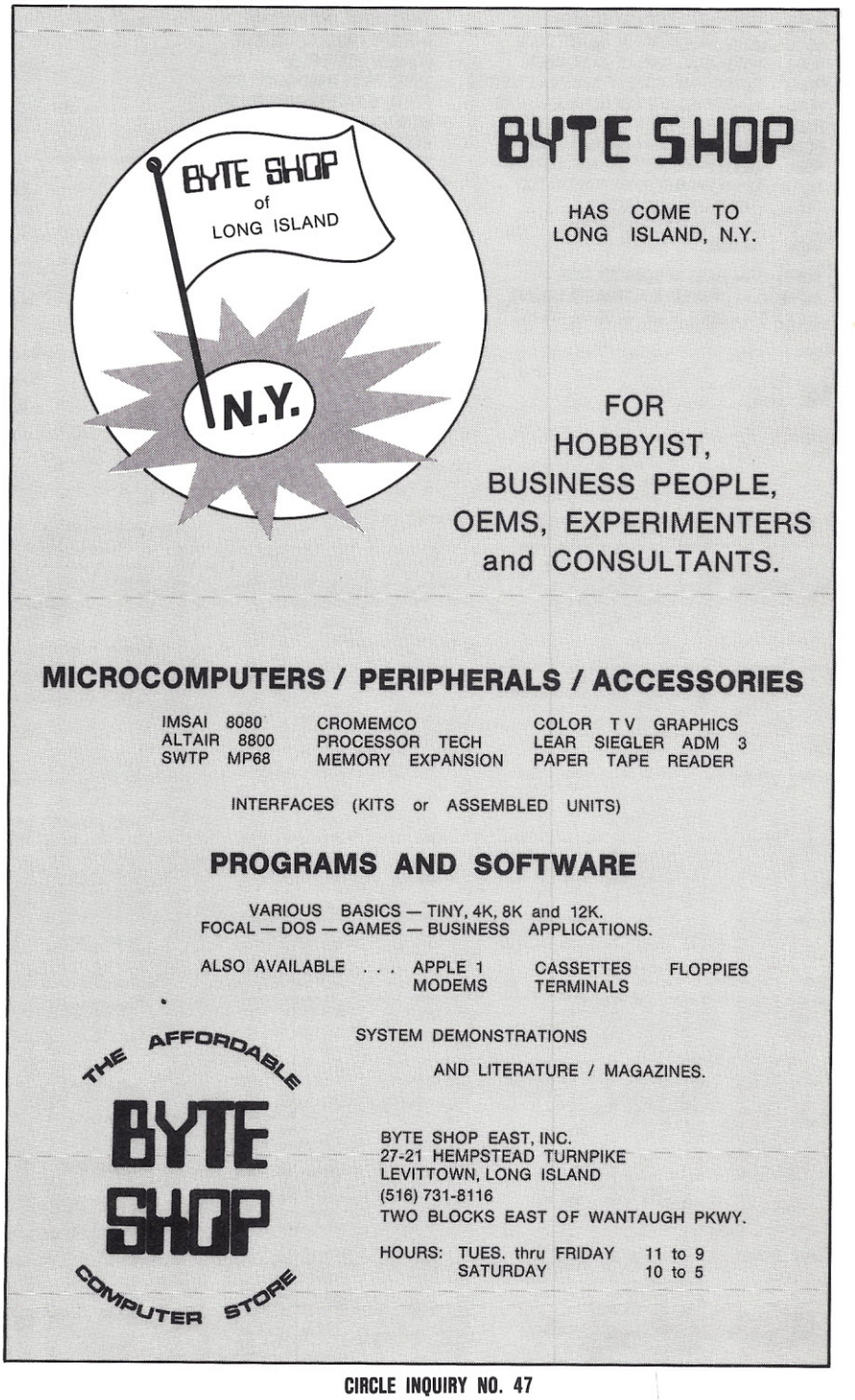
INTERFACE BUGS

Article - Floating Point Routines for 6502 by Roy Rankin & Steve Wozniak, page 103, Nov. 1976 issue. Change the sign of the number +128 of the fourth and fifth paragraphs, from + to - 128. Change ERROT in the third to the last line of the last paragraph on the page to ERROR.

Inexpensive Microcomputer Software

The Microcomputer Software Depository (MSD) will act as repository for source and object code tapes. Programmers wishing to contribute programs to the public domain but who do not want to bother with distribution, may do so by forwarding appropriate documentation including short descriptive write-up and punch paper tape copy of program if possible or cassette copy to MSD. There is no membership fee for access to the public domain paper tapes (PDT) from MSD.

Anyone may obtain copies of these PDT software packages by prepaying a small fee with the order to cover duplication, postage and handling cost. Prices will be listed periodically in INTERFACE AGE. Typical cost for a short program will be approximately $2.00 ($2.00/03) + tax, postage and handling. As a convenience MSD will



CIRCLE INQUIRY NO. 47

also provide punched paper tape copies of vendor supplied software packages (VSP) that will be sold at vendor suggested sale prices. For a current copy of the available software from the Microcomputer Software Depository (MSD) send a check for $1.00 with a prestamped return envelope to MSD.

Support MSD to build a software library by sending copies of your documented software programs including short description, flow diagrams and punched paper tape source code and object listings if possible or cassette tape copy for low cost distribution to the following address: Microcomputer Software Depository, 2361 E. Foothill Blvd., Pasadena, CA. 91107, (213) 449-0616.

MICROCOMPUTER SOFTWARE DEPOSITORY (MSD) PROGRAMS

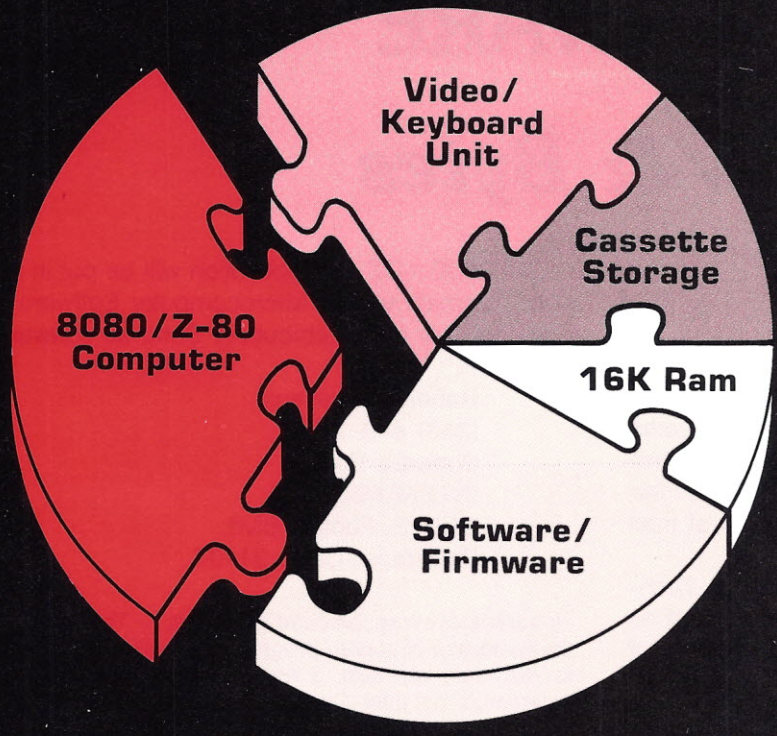
PTOD PAPER TAPE OBJECT DUMP
PTBL PAPER TAPE BASIC LISTING
CTAL CASSETTE TAPE ASSEMBLY LISTING
CTSL CASSETTE TAPE SOURCE LISTING
CTOL CASSETTE TAPE OBJECT LISTING
CTOD CASSETTE TAPE OBJECT DUMP
CTBC CASSETTE TAPE BASIC CODE
CTBL CASSETTE TAPE BASIC LISTING
HCAC XEROX HARD COPY OF ASSEMBLY CODE
HCSC XEROX HARD COPY OF SOURCE CODE
HCOC XEROX HARD COPY OF OBJECT CODE
HCBC XEROX HARD COPY OF BASIC CODE
HCAL XXEROX HARD COPY OF ASSEMBLY LISTING
HCSL XEROX HARD COPY OF SOURCE LISTING
HCOL XEROX HARD COPY OF OBJECT LISTING
HCOD XEROX HARD COPY OF OBJECT DUMP
HCBL XEROX HARD COPY OF BASIC LISTING
TEXT XEROX HARD COPY OF PRINTED TEXT
PTTL PAPER TAPE TEXT LISTING
CTTL CASSETTE TAPE TEXT LISTING
MAN MANUAL

SUFFIX C — HAND ASSEMBLED CODE
SUFFIX L — COMPUTER FORMATED LISTING
SUFFIX D — CODE DUMP IN OCTAL OR HEX

NOTES
* CALIF. SALES TAX REQUIRED FROM RESIDENTS OF CALIF.
: USA POSTAGE + HANDLING OR THIRD CLASS USA POSTAGE + HANDLING OR SURFACE RATE FOREIGN POSTAGE @ THREE TIMES THIRD CLASS USA POSTAGE RATE (STANDARD) OR SURFACE RATE FOREIGN POSTAGE @ FIVE TIMES USA POSTAGE RATE (ALTERNATE)
< NEW PROGRAM LISTING
% VENDOR SOFTWARE PACKAGE — ALL OTHER PROGRAMS ARE PUBLIC DOMAIN SOFTWARE WITH THE ONLY RESTRICTION THAT THESE PROGRAMS ARE NOT TO BE SOLD IN ANY FORM AT ANY PRICE.

CPU TYPE	SYMBOLIC NAME	DESCRIPTIVE NAME	MSD # & MEDIA	R E V #	PRICE IN $ + CALIF. TAX(*) + USA POSTAGE(:)
6502	APPLEDA	6502 APPLE COMPUTER DISASSEMBLER BY ALLEN BAUM & STEPHEN WOZNIAK-INTERFACE AGE, SEPT. 1976, VOL.1,#10.	1-TEXT 1-HCAL		1.00+0.06+0.50 INC. WITH TEXT
8080	LPTIIHF	LOAD 8080 PAPER TAPE IN INTEL HEX FORMAT BY BURT HASHIZUME-INTERFACE AGE, OCT. 1976, VOL.1,#11.	2-PTAL 2-TEXT 2-HCAL	0	2.00+0.12+1.00 1.00+0.06+0.50 INC. WITH TEXT
8080	BEWOA	8080 BINARY FILES WITH OPTIONAL AUTOSTART BY WILLIAM H. JORDAN-INTERFACE AGE, OCT. 1976, VOL.1,#11.	3-PTAL 3-PTOD 3-TEXT 3-HCAL	0	2.00+0.12+1.00 INC. WITH PTAL 1.00+0.06+0.50 INC. WITH TEXT
6800	MINOPS	MIN OPERATING SYSTEM BY ED KEITH & DENNIS HESCOX-INTERFACE AGE, OCT. 1976, VOL.1,#11. PTAL+ INCLUDES OPERATING INSTRUCTIONS, PAPER TAPE FORMAT AND SAMPLE RUN	4-PTAL+< 4-PTOD 4-TEXT 4-HCAL	0	2.00+0.12+1.00 INC. WITH PTAL 1.00+0.06+0.50 INC. WITH TEXT
8080	DBBDP	DR. BEATTIE'S BASIC DIET PLANNING BY DR. BEATTIE-INTERFACE AGE, OCT. 1976, VOL.1,#11.	5-TEXT 5-HCSL 5-PTSL	0	1.00+0.06+0.50 INC. WITH TEXT 3.00+0.18+1.00
6800	EZMEMPS	ECHO 1, ZERO MEMORY, ECHO REVERSE & PRINT SUBROUTINES BY HOWARD HERENDON-INTERFACE AGE, OCT. 1976, VOL.1,#11.	6-PTAL 6-TEXT 6-HCAL	0	2.00+0.12+1.00 1.00+0.06+0.50 INC. WITH TEXT
8080	ESP-1	ESP-1 SOFTWARE PACKAGE BY MICHAEL SHRAYER-INTERFACE AGE, OCT. 1976, VOL.1,#11.	7-PTOD % 0 7-MAN 7-PTTL 7-PTTL 7-TEXT		29.50+1.77+1.50 INC. WITH PTOL INC. WITH PTOL 1.00+0.06+0.60 INC. WITH PTTL
8080	PTSP-1	PROCESSOR TECHNOLOGY SOFTWARE PACKAGE NO. 1 SUMMARY BY R. A. STEVENS-INTERFACE AGE, OCT. 1976, VOL.1,#11.	8-PTTL % 0 8-TEXT		1.00+0.06+0.60 INC. WITH PTTL
8080	EXAMMT	EXHAUSTIVE 8080 RAM MEMORY TEST PROGRAM BY T.E.TRAVIS -INTERFACE AGE, NOV. 1976, VOL.1,#12.	9-PTAL 9-PTOD 9-TEXT 9-HCAL 9-HCOD	0	2.00+0.12+0.50 INC. WITH PTAL 1.00+0.06+0.50 INC. WITH TEXT INC. WITH TEXT
6800	MEMDMP-1	SWTPC 6800 MEMORY DUMP PROGRAM MEMDMP-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	10-PTAL 10-PTSL < 10-PTOD < 10-TEXT 10-HCAL	0 0	2.00+0.12+1.00 2.00+0.12+1.00 INC. WITH PTSL 1.00+0.06+0.75 INC. WITH TEXT
6800	KOBIT-1	SWTPC 6800 ROTATING BIT RAM MEMORY DIAGNOSTIC PROGRAM KOBIT-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	11-PTAL 11-PTSL < 11-PTOD < 11-TEXT 11-HCAL	0 0	2.00+0.12+1.00 2.00+0.12+1.00 INC. WITH PTSL 1.00+0.06+0.75 INC. WITH TEXT
6800	MEMCON-1	SWTPC 6800 SHORT MEMORY ADDRESS CONVERGENCE PROGRAM MEMCON-1 BY GARY KAY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	12-PTAL 12-PTSL < 12-PTOD < 12-TEXT 12-HCAL	0 0	2.00+0.12+1.00 2.00+0.12+1.00 INC. WITH PTSL 1.00+0.06+0.75 INC. WITH TEXT
6800	BJIB	BLACKJACK IN BASIC PROGRAM BY ED KEITH & DENNIS HESCOX. THE BJIB PAPER TAPE OBJECT CODE REQUIRES ROBERT UITENBYK'S SWTPC MICROBASIC OPERATING SYSTEM-INTERFACE AGE, NOV. 1976, VOL.1,#12. PTBL+ INCLUDES SAMPLE RUN, INSTRUCTIONS, LIST OF VARIABLES AND LIST OF ROUTINES.	13-PTBL 13-PTBL+< 13-PTOD 13-TEXT 13-HCBL 13-HCOD	0	5.00+0.30+1.00 6.00+0.36+1.00 6.00+0.36+0.75 1.00+0.06+0.50 INC. WITH TEXT INC. WITH TEXT
6502	REPR	REVISED FLOATING POINT ROUTINES FOR 6502* BY ROY RANKIN & STEVE WOZNIAK - INTERFACE AGE, NOV. 1976, VOL.1,#12. NOTE * - ORIGINAL MATH PACKAGE FIRST APPEARED IN DR. DOBB'S JOURNAL, AUG. 1976, VOL.1,#7.	14-PTOD 14-PTAL 14-PTSL < 14-TEXT 14-HCAL	1	3.00+0.18+0.60 9.00+0.54+1.50 9.00+0.54+1.50 1.00+0.06+0.50 INC. WITH TEXT
6800	HISPDMUP	HIGH SPEED DOUBLE PRECISON MULTIPLICATION SUBROUTINE-HISPDMUP BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	15-PTAL 15-TEXT 15-HCAL	0	2.00+0.12+0.50 1.00+0.06+0.50 INC. WITH TEXT
6800	DIV16	REENTRANT 16 BIT DIVIDE SUBROUTINE - DIV16 BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.	16-PTAL 16-TEXT 16-HCAL	1	2.00+0.12+0.50 1.00+0.06+0.50 INC. WITH TEXT
6800	RENTMUP	REENTRANT DOUBLE PRECISION MULTIPLICATION SUBROUTINE-RENTMUP BY PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY-INTERFACE AGE, NOV. 1976, VOL.1,#12.	17-PTAL 17-TEXT 17-HCAL	0	2.00+0.12+0.50 1.00+0.06+0.50 INC. WITH TEXT
8080	HOMEC	COMPUTER OR CONTROLLER BY TERRY BENSON, INTEL - INTERFACE AGE, SEPT. 1976, VOL.1,#10.	18-PTAL 18-PTSL 18-TEXT 18-HCAL	0	2.00+0.12+0.50 2.00+0.12+0.50 1.00+0.06+0.50 INC. WITH TEXT
8080	LCST	STARTREK BY LYNN COCHRAN-INTERFACE, JUNE 1976, VOL.1,#7.	19-PTBL 19-TEXT 19-HCBL	0	2.00+0.12+0.75 1.00+0.06+0.50 INC. WITH TEXT
8080	WSPG	WORD SEARCH PUZZLE GENERATOR BY RICHARD S. EDELMAN - INTERFACE, JULY 1976, VOL.1,#8.	20-PTBL 20-TEXT 20-HCBL	0	2.00+0.12+0.75 1.00+0.06+0.50 INC. WITH TEXT
8080	PGBIORHY	BIORHYTHM BY PAUL GREEN - INTERFACE AGE, AUG. 1976, VOL.1,#9.	21-PTBL 21-TEXT 21-HCBL	0	2.00+0.12+0.75 1.00+0.12+0.50 INC. WITH TEXT
8080	WDBIORHY	BIORHYTHMS IN PRACTICE BY WILLIAM L. DONHAN, M.D. - INTERFACE AGE, AUG. 1976, VOL.1,#9.	22-PTBL 22-TEXT 22-HCBL	0	2.00+0.12+0.75 1.00+0.06+0.50 INC. WITH TEXT
8080	KERJ	BLACKJACK BY RICHARD S. EDELMAN - INTERFACE AGE, AUG. 1976, VOL.1,#9.	23-PTBL 23-TEXT 23-HCBL	0	2.00+0.12+0.75 1.00+0.06+0.50 INC. WITH TEXT
8080	BLUFF	BLUFF BY PHIL FELDMAN & TOM RUGE - INTERFACE AGE, SEPT. 1976, VOL.1,#10.	24-PTBL 24-TEXT 24-HCBL	0	2.00+0.12+0.75 1.00+0.06+0.50 INC. WITH TEXT
6800	KABSIMB	KELATIVE ADDRESS BACK-STEPPER IN MICRO-BASIC BY J. HUFFMAN - INTERFACE AGE, DEC. 1976, VOL.1,#13.	25-PTBL < 25-HCBL < 25-TEXT <	0	2.00+0.12+0.75 1.00+0.06+0.25 INC. WITH HCBL
6800	TEXT6800	TEXT EDITOR FOR THE SWTPC-6800 BY MARK BORGERSON - INTERFACE AGE, DEC. 1976, VOL.1,#13.	26-PTAL < 26-PTOD < 26-HCAL <	0	10.00+0.36+2.00 5.00+0.30+1.25 2.00+0.12+1.25
8080	WHATBX	WANG'S PALO ALTO TINY BASIC BY ROGER KAUSKOLB - INTERFACE AGE, DEC. 1976, VOL.1,#13.	27-PTSL < 27-PTOD < 27-HCAL < 27-TEXT < 27-HCSL <	0	10.00+0.60+2.00 5.00+0.30+1.50 2.00+0.12+1.50 INC. WITH HCAL 2.00+0.12+1.00
8080	LLLBI	LLL 8080 BASIC INTERPRETER GRAMMAR BY JERRY BARBER & ROYCE ECKARD - SUBMITTED BY E.K. FISHER - INTERFACE AGE, DEC. 1976, VOL.1,#13.	28-TEXT <	0	2.00+0.12+1.25
SC/MP	NIBL	NIBL-NATIONAL'S TINY BASIC GRAMMAR FOR SC/MP BY PHIL ROYBAL - INTERFACE AGE, DEC. 1976, VOL.1,#13.	29-TEXT <	0	2.00+0.12+1.25
SC/MP	MWBAGELS	BAGELS BY DR. MARVIN MINZINKEAD BY PERMISSION & COURTESY OF NATIONAL SEMICONDUCTOR - INTERFACE AGE, DEC. 1976, VOL.1,#13.	30-PTBL <	0	2.00+0.12+1.00
8080	AMS80	AMSAT 8080 STANDARD DEBUG MONITOR BY RICHARD C ALLEN & JOE KASSER - BYTE # 13, SEPT. 1976, VOL.2,#1. SUBMITTED BY JOE KASSER.	31-PTSL < 2 31-PTOD <		10.00+0.60+2.00 3.00+0.18+1.75

THE SEARCH IS OVER



Computer Systems Unlimited PUTS IT ALL TOGETHER!

Of course you can buy a piece here and there and come up with a workable system, but why not move into a sensibly "matched" computer system by COMPUTER SYSTEMS UNLIMITED?

We take the best items from some of the most respected computer manufacturing companies in the country, add some of our own special ideas and technology, and put it all together into a well-balanced system.

UNPRESIDENTED 6 MONTH WARRANTY

Before the C.S.U. seal goes on each unit, it is tested, checked out, and burnt-in as a system. That's your guarantee of getting a computer that works when you first turn it on and keeps on working time after time.

Can we put one together for you?

Computer Systems Unlimited
18886 Hesperian Blvd.
Hayward, Ca. 94541
(415) 278-2667 or CSU-COMP
Store Hours: Wed.-Fri. by Appointment / Sat. & Sun. 1-7 p.m.

Computer Systems Unlimited announces . . .



THE MUSIC BOARD — Only $39.95. Just in time for Xmas it's the ideal gift for yourself or a friend. The C.S.U. Music Board comes fully assembled, ready to plug-in and use. Your Xmas package comes GIFT WRAPPED and contains: 1) assembled music board, 2) alpha numeric music booklet, 3) programs to play Jingle Bells and other Xmas favorites, and 4) documentation and instructions for writing your own music. The C.S.U. Music Board comes with it's own speaker or you can use it's phono plug to drive your stereo. Don't be a SCROUGE!!! Treat yourself to a musically Merry Xmas that you'll enjoy the whole year long. Order yours today — or let your wife get it for you! Just **$39.95.**

+ — × ÷ + — × ÷ + — × ÷ + —

NEW! NEW! NEW! NEW!

Hardware Floating Point Board. High speed BCD add, subtract (20 us), multiply, divide (100 us) up to 14 digits of precision. Comes with powerful 8K Basic (strings of any length, user defined functions, formated output capability), to help you use it to it's full potential.

Assembled $499. Unassembled $359.

C.S.U. System Special #1

I-8080, 22 slot motherboard with 12-100 pin connectors, 16K fast RAM, MIO Board (1-SIO, 2-PIO, Byte/Tarbell Cassette), Poly 64 Character Video Interface, and enclosed ASC II Keyboard.

Assembled $2602. Unassembled $1890.

C.S.U. System Special #2

Poly 88 (filled with 100 pin connectors), 64 Character Video, 16K RAM, ROM Operating System, Byte Cassette, 1-SIO Port, and ASC II Encoded Keyboard in an attractive case. Turn it on, its ready to use.

Assembled $1839. Unassembled $1495.

C.S.U. System Special #3

Same as system #1, but with super ZPU board, 24 x 80 CRT, and PROM Operating System on Byte Saver PROM Programmer (replacing C.P.U., Poly V.T.I. and Keyboard).

Assembled $3932. Unassembled $2865.

Systems come complete with Cables, Connectors, Books, and Documentation.

High resolution 12" T.V./Monitor with Connective Cables — $150.

Special Cassette Recorder with Cables and Low Noise Cassette — $75.

SOFTWARE

Bits & Bytes

INTEL ANNOUNCES EXPANDED MICROCOMPUTER USER'S PROGRAM LIBRARY SERVICE

Hundreds of microcomputer source code programs will be made available on paper tape and in listing form through a new, expanded user's library announced today by the Microcomputer Systems Division of Intel Corporation.

Named Insite ™ (Intel Software Index and Technology Exchange), the new library will be operated as an industry service by INTEL. INSITE™ is an outgrowth of the Intel Microcomputer User's Library of general-purpose microcomputer programs. INTEL's customers have been contributing programs to the library for several years. It now contains over 200 programs for 8080 and 8008 8-bit microcomputers and over 100 programs for 4040 and 4004 4-bit microcomputers.

A new Program Library Manual will contain all programs with listings up to three pages long. The first edition, to be published in September, will contain 150 programs from the original library plus 50 new programs. Programs longer than three pages will be described in authors' abstracts. Update packages for the manual, containing newly received programs, will be published every other month.

Paper tapes containing source code for each of the programs in the library will be made available on request. A prepaid handling fee of $15 will be charged for each source tape. As a bonus, new members will receive five free source tapes of their choice when they return their registration card.

A one year membership in the library is free to persons who contribute acceptable programs. The membership fee for other persons is $100 annually. Members will receive the program library manual and update packages during the term of their membership.

Key among the new library programs are two BASIC compilers for use on the 8080A microcomputer. One executes on a paper tape based system while the other requires a disk system. Both will be available for the reproduction price of $15 each.

Software Editor's note: If you submit a program to the INTEL user's library, also (at the same time) submit a copy of your paper tape source code and short descriptive write up to INTERFACE AGE for publication and get paid for your effort. INTERFACE AGE pays $15.00 to $30.00 per typeset page for original Microcomputer software programs. All programs submitted to INTERFACE AGE for publication will be put in the free public domain vie the Microcomputer Software Depositary for low cost distribution. Send all software programs to

Robert A. Stevens
(213) 449-1655
Software Editor
INTERFACE AGE
2361 E. Foothill Blvd.
Pasadena, Calif., 91107

Hundreds of microcomputer programs — These are some of the hundreds of source programs that will be made available to members of Insite, a new microcomputer user's library sponsored by Intel Corporation's Microcomputer Systems Division.

8080 RESIDENT COMPILER AND MODULAR PROGRAM DEVELOPMENT OPERATING SYSTEM

Intel Corporation's Microcomputer Systems Division announced a new software development operating system for the Intel 8080A Microcomputer.

The new system, which is resident on the Intellec R Microcomputer Development System (MDS), provides the first comprehensive software package for design with a high-level language and resident compiler along with support software to automatically link program modules together to form an applications program.

The system supports programming of 8080 microcomputer products based on the 8080A Central Processor Unit. The new system consists of two software packages: a resident version of the PLM-80 Compiler for the 8080A and ISIS-II, a new Diskette Operating System. PL/M is a high-level programming language for microcomputers while ISIS-II is a new version of the Intel Systems Implementation Supervisor. The two packages are supplied on diskettes. The compiler is priced at $975. ISIS-II is included with the diskette system hardware.

Resident PL/M Compiler

The new PL/M Compiler fully supports modular software design by generating linkable and relocatable object code modules. These software modules can be automatically joined to each other, or with object code modules produced by a new relocating Macro Assembler contained in the ISIS-II package. The previous 8080A PL/M compiler was a cross compiler, written in FORTRAN to run on other large computers such as the IBM 360 or 370. The new compiler is resi-

dent and runs right on the 8080A itself.

In addition, the compiler has several other major new features. It allows the programmer to define data structures and also gives him access to absolute addresses. The user can request the compiler to generate reentrant code for any procedure. The compiler will also produce a cross-reference listing on request and optionally print an "innerlist" of generated assembly language after each PL/M statement.

New Diskette Operating System

ISIS-II includes all other software operating system modules required for modular programming. These modules include a new Macro Assembler, Linker, Locater and Library Manager. ISIS-II also contains a Text Editor with string search, substitution, insertion and deletion commands. In addition, the Text Editor provides access to the System Monitor, which contains diagnostic aids and drives all peripherals.

The Macro Assembler differs from previous 8080 Macro Assemblers primarily in its ability to generate linkable and relocatable code. The assembler also provides full macro capability, expanded from the previous version and also will produce a cross-reference listing.

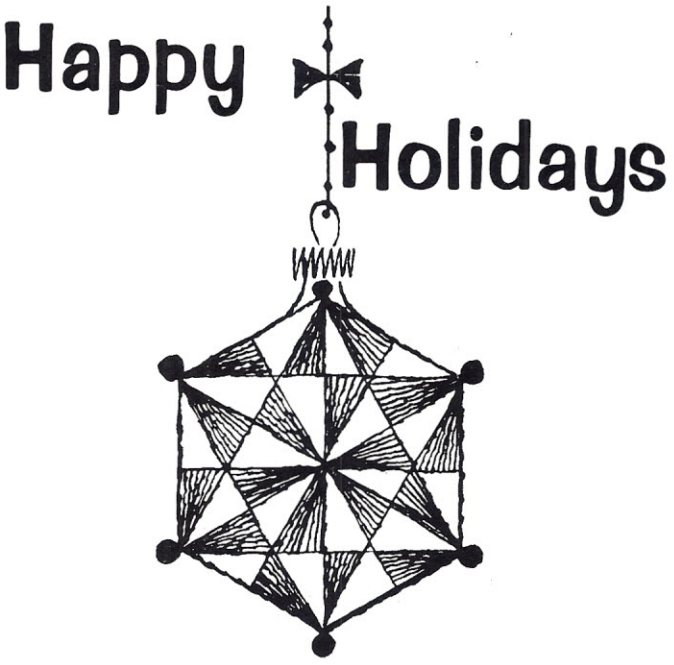
With the Library Manager, the system user can create and utilize a library of subroutines or other program modules prepared by the Compiler and Macro Assembler. These program modules are stored in linkable and relocatable form on diskettes, and retrieved automatically by the linker when referenced by a program.

The Linker uses the inter-module references to combine several object code modules into a single object module. After linking, the Locater is used to locate the program at a user specified memory address. Separate addresses can be specified for code, data and stock. The program can then be executed by the Intellec system.

Summary

The new system's main benefits, compared with previous microcomputer programming systems, are:

- Software design time can be drastically reduced and lowered in cost by using PL/M. Now that PL/M is resident on the Intellec instead of a cross compiler on a large computer or time-shared computer network, the cost reduction is even greater.
- Designers can use different source languages for different modules with assurance that object codes will merge properly and easily.
- Proven modular programming techniques can be used with the knowledge that all program linking can be done automatically.
- Field proven subroutines such as standard peripheral drivers and arithmetic packages can simply be retrieved from the library instead of being manually included in each application.
- Software documentation can be substantially enhanced through the use of PL/M and the modular approach to software development greatly aids software maintenance and eases system enhancement.
- Program reliability can be greatly improved, since the use of PL/M aids the designer in producing reliable software. In addition, the use of proven library routines also improves software reliability.



microcomputers

— Computers for People —

IMSAI 8080

At Special Introductory Prices
(Prices Effective Until December 31, 1976 Only)

I-8080 Kit $506
I-8080 Kit with 22 Slot Mother $550

- Add $9 each for shipping and handling
- New York residents add Sales Tax
- Send check or money order for full amount (Allow 3 weeks for personal checks.)

master charge
WE TAKE MASTERCHARGE OR BANKAMERICARD
BANKAMERICARD

FOR MAIL AND PHONE ORDERS

For orders, information or special prices on all IMSAI products

Call: (315) 637-6208

Write:

computer enterprises

P.O. Box 71 • Fayetteville, N.Y. 13066

Ask for Our Special Price Sheet.

CIRCLE INQUIRY NO. 49

Relative Address Backstepper

In Micro-Basic — RABSIMB

By J. Huffman

Generation of this program arose out of a need to hand-assemble short assembly language programs for my 6800 microprocessor. However, it lends itself well to other microprocessors which operate with the relative addressing mode. The program takes the number of back-steps that have to be made in a relative address and converts these to hexidecimal form with zero back-steps being an invalid condition. Therefore, zero back-steps is used to escape from the program. Otherwise, the program is a loop and keeps asking for relative address information each time after it computes the hexidecimal address. One of the more important things to note about this program is that it is written to be compatible with micro-basic compilers. That means it will run on a machine that has full or extended Basic with no modification. You'll have to look at the input commands to make sure they're compatible with your machine, but basically: (1) No floating point arithmetic; (2) no string inputs; (3) no exponential arithmetic. The program occupies 3,680 bytes and therefore runs well with Southwest Technical Product's Micro-Basic in only 4 K of RAM.

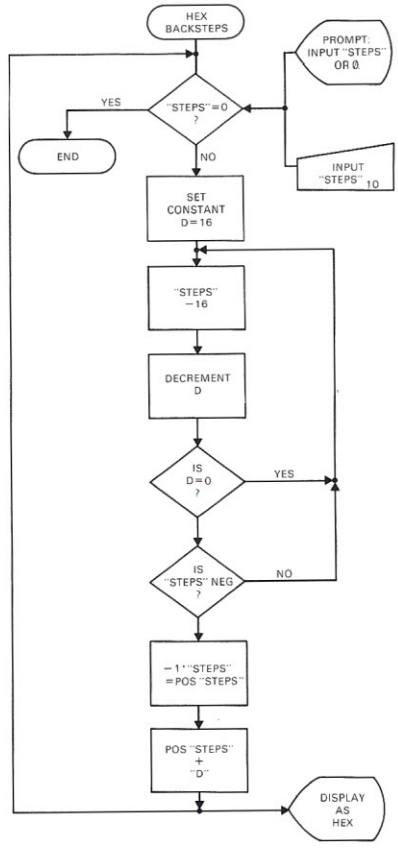
Figure 1 is a detailed flow chart of the operation of the program so that it may be written for programmable calculators or may be written in Fortran or any other language that you might have available. Basically, the program uses a subtractive process. The number of back steps are entered in decimal and the program subtracts base 16 and decrements a register which contains the number base (16) for the program. As soon as the number of steps have been decremented to the point where they are negative, the program converts the negative remainder to a positive number and then prints out the hexidecimal equivalent of that number. The first hexidecimal character is the equivalent hexidecimal character of whatever remained in the register that stored the original 16 base. Typically, a run program will look like this:

```
RUN
INPUT NO. OF STEPS (0 TO ESCAPE)
?8
F8
?48
C.... NEW CHARACTER
D0
?0

# READY
```

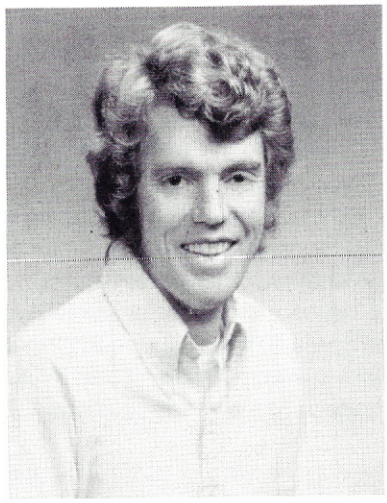
SEE MICROCOMPUTER SOFTWARE DEPOSITORY PROGRAM INDEX FOR COPIES OF THIS PROGRAM

```
000  REM PROGRAM NAME: RELATIVE ADDRESS
001  REM               BACK-STEPPER IN
002  REM               MICRO-BASIC
003  REM SYMBOLIC NAME: RABSIMB
004  REM PROGRAMMER: J. HUFFMAN
005  REM MICROCOMPUTER: SWTPC 6800
006  REM SUPPORTING SOFTWARE: MICRO-BASIC
007  REM REQUIRED MEMORY: 4K RAM
008  REM
010  REM ****BACKSTEPS TO HEX PGM
020  PRINT "ENTER NO. STEPS (OR GO TO EXIT)"
021  REM ENTER IN NUMBER OF DECIMAL STEPS
025  PRINT
030  INPUT S
035  IF S=0 END
040  IF S>125 PRINT "TOO BIG CAN'T JUMP THAT FAR"
041  REM CANNOT BACKSTEP OVER 125 SO THIS IS
042  REM CHECK FOR IT
050  LET D=16
060  LET S=S-16
061  REM SUB DECIMAL 16 FROM STEPS
065  LET D=D-1
066  REM DECREMENT D
070  IF D=0 GOTO 60
071  REM IF D=0 REPEAT
075  IF S>=0 GOTO 60
076  REM IF S POSITIVE REPEAT
080  LET X=D
081  REM SETUP FOR SUBROUTINE
085  GOSUB 150
086  REM PRINT D AS 0-F
090  LET X=-1*S
091  REM MAKE S POSITIVE & SET FOR SUBR.
095  IF X<16 GOTO 118
096  REM IF S>16 MAKE NEW CHARACTER
100  LET D=D+1
101  REM INCREMENT D
105  PRINT ".....NEW CHARA"
110  LET X=D
112  GOSUB 150
114  PRINT "0"
115  REM PRINT NEW D FOLLOWED BY 0
116  GOTO 120
117  REM GET MORE DATA
118  GOSUB 150
119  PRINT
120  GOTO 25
150  IF X<10 PRINT X;
151  REM LOOK UP TABLE FOR 0-9 & A-F
160  IF X=10 PRINT "A";
170  IF X=11 PRINT "B";
180  IF X=12 PRINT "C";
190  IF X=13 PRINT "D";
200  IF X=14 PRINT "E";
210  IF X=15 PRINT "F";
220  RETURN
```

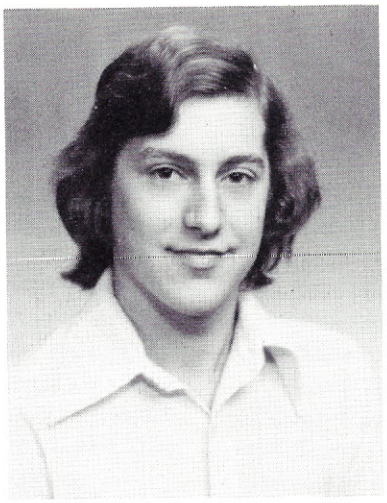


THE 1976 COMPUTER

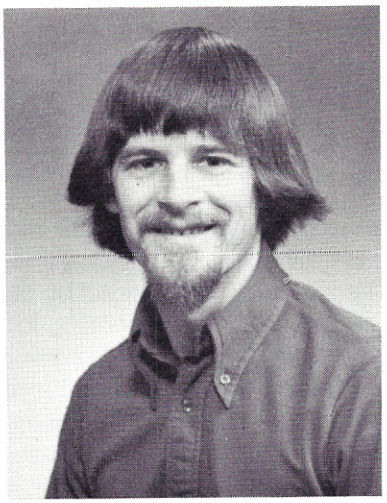
STORE ALL-STARS



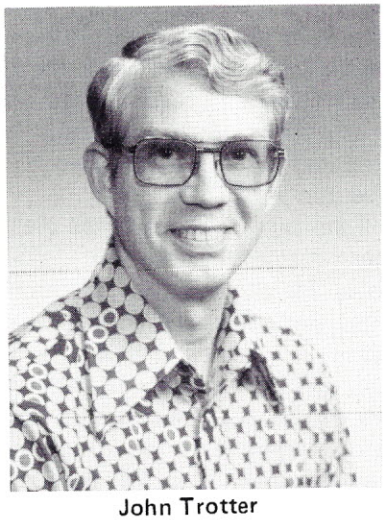
Mike Eusey



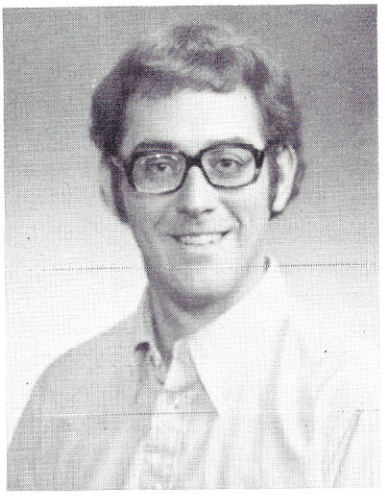
Steve Zook



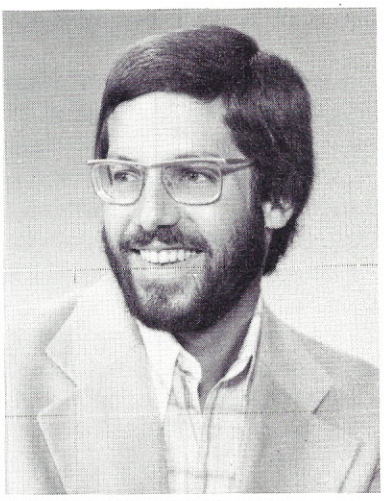
Gary Shannon



John Trotter



Jim Modecki



Dick Heiser

The most experienced computer dealers anywhere

THE COMPUTER STORE

820 Broadway
Santa Monica, Calif. 90401
Phone (213) 451-0713

mits altair™ COMPUTER CENTER

Authorized dealer for:
MITS, Southwest Technical, Polymorphic, Cromemco, Microterm, Oliver, TDL, Sanyo
BY POPULAR DEMAND! NEW HOURS!! TUES – FRI Noon - 8 p.m., SAT 10 a.m. - 6 p.m.
Located 2 blocks North of the Santa Monica Freeway at the Lincoln Blvd. exit

CIRCLE INQUIRY NO. 55

Exhaustive Memory Testing

By T. E. Travis

Once the proud microcomputer builder has finally plugged the last PCB into its socket and run through the last test sequence recommended by the manufacturer, he (or she) sooner or later gets around to deciding that all of that memory beyond the first few bytes used during the CPU tests should be tested also. However, unless some care is exercised, it is surprisingly easy to write a memory test program that appears to test all of memory, but in reality, does no such thing. This article describes some of the pitfalls of memory testing, and presents a sample 8080 program which is designed to detect some of the more subtile forms of memory errors.

Memory test programs are conceptually quite simple: write data into each memory location and see if it can be read back out correctly. Each bit location in each byte is supposed to be able to store either a zero or a one, so for each location why not just write a byte of all ones, read it back, then repeat the process for an all zero byte and move on to the next word until the whole memory has been tested? Well for one thing, suppose bits four and five are tied together on one of your memory boards by a solder bridge. So long as both bits are tested with either a zero or a one, this error would go undetected. More complicated errors would be even harder to find. Consequently, the first level of sophistication in memory testing is to make multiple passes through the memory until each byte has been tested with each of the 256_{10} possible eight bit patterns.

Okay, now suppose that address bit eight is stuck low on one of your memory boards due to a bad address buffer. This means that data addressed to any location with address bit eight high will end up in the location 256 bytes lower than that location. However, since the read address used to test to see if the data was stored correctly will suffer the same fate, the data will be read correctly, but from the wrong location. Trying to find such an address decoding error can be very frustrating without a well designed test program.

To test for address decoding errors, two changes to the simple 256 pass test program are necessary. First, it does no good to read out a location immediately after it is written. This does not give any interfering addresses a chance to disturb the test pattern. Next, the patterns written into different test locations cannot all be the same. Otherwise, there will be nothing to indicate that interference has taken place. Unfortunately, there are only 256 possible eight bit patterns which can be written into memory, so it is impossible to write a unique pattern into every memory location. Therefore, what is needed is either a scheme which tests every possible byte pair for interference, or a less exhaustive one that varies the spacing of bytes with the same pattern so as to increase the probability of detecting the more common forms of decoding errors.

The testing of every possible pair of bytes is not out of the question. However, for a 16 K byte memory, the most direct form of such a test would run almost two hours. Consequently in the sample program presented below, a less exhaustive test was used. However, for any one who may be interested, the basic form of the exhaustive test is as follows (for speed, this test does not attempt to detect any other forms of errors):

1. Write all zeros into the byte under test
2. Write all ones into every other byte
3. Test to see if the byte under test was disturbed
4. Go to the next byte and repeat 1-3.

The memory test for 8080 based systems listed below does not use this exhaustive form of the interference test. In this way, it can test a 16 K byte memory with every possible pattern in every possible byte in about four minutes. This test can be run in a system with no peripherals and, in the case of an error, saves the address of the bad location and the pattern which should have been stored there. By comparing this pattern with the data actually in the bad location, it is possible to get an indication of what type of error occurred.

In this program, memory can be thought of as being divided into consecutive 256 byte blocks. During any one pass through the memory, the sequence of byte patterns stored in any block is different from the sequence stored in any other block. Futhermore, no eight bit byte pattern repeats itself within a block. It is this combination of features which aids in detecting address decoding errors. From pass to pass, the sequence of patterns in any given byte varies until all 256 possible patterns have been tested after 256 passes. This allows the test to detect any form of stuck bit or tied together bit errors.

To generate the basic test pattern for a given byte the high and low bytes of its address are exclusive or'ed together. In addition, the B register is used as a modulo

256 pass counter which is also exclusive or'ed with the basic pattern to cause it to vary from pass to pass. The exclusive or operation is used in forming the test pattern because it does not change the relative frequency of ones and zeros in the test patterns and because it is its own inverse. This allows one to easily determine what pass the test failed on without having to save the pass counter.

The flow chart for this routine shows it to be broken down into three major segments; the first portion forms and writes the test patterns, the second reads and tests them for accuracy and the third is the error exit which is used if an error is detected. In this flow chart, the numbers to the right of each block correspond to the HEX address of the code which performs the function in the block.

To use this program, it can be loaded into memory with the front panel switches and executed beginning at location zero. As long as no errors occur, the program will continue to run (an overnight run without errors is a great confidence builder). If an error should occur, the program will halt. If this happens, examine locations 002D and 002E for the address of the bad byte, location 2C for the correct data pattern and the location pointed to by locations 002D and 002E for the incorrect data. By noting where the two patterns differ, the bit(s) in error can be identified.

```
                ;PROGRAM NAME: EXAUSTIVE 8080 RAM MEMORY TEST
                ;PROGRAM SYMBOLIC NAME:  EXAMMT
                ;PROGRAMMER:  T. E. TRAVIS
                ;STORAGE REQUIREMENTS:  43 BYTES
                ;I/O INTERFACE REQUIREMENTS:  NONE
                ;REQUIRED SUPPORTING SOFTWARE:  NONE
                ;
                ;ASSEMBLY LISTING
                ;
0000 0600               MVI     B,0     ;CLEAR B (PATTERN MODIFIER)
                ;
                ;FILL MEMORY WITH TEST DATA
                ;
0002 212F00     LOOP:   LXI     H,START ;LOAD STARTING ADDRESS 002FH
0005 7D         FILL:   MOV     A,L     ;LOAD LOW BYTE OF ADDRESS
0006 AC                 XRA     H       ;EXCLUSIVE OR WITH HIGH BYTE
0007 A8                 XRA     B       ;EXCLUSIVE OR WITH MODIFIER
0008 77                 MOV     M,A     ;STORE TEST PATTERN
0009 23                 INX     H       ;INCREMENT ADDRESS (H&L)
000A 7C                 MOV     A,H     ;LOAD HIGH BYTE OF ADDRESS
000B FE20               CPI     EPAGE   ;COMPARE WITH STOP ADDRESS
000D C20500             JNZ     FILL    ;IF NOT DONE, GO BACK TO 0005H
                ;
                ;READ AND CHECK TEST DATA
                ;
0010 212F00             LXI     H,START ;RELOAD STARTING ADDRESS
0013 7D         TEST:   MOV     A,L     ;LOAD LOW BYTE OF ADDRESS
0014 AC                 XRA     H       ;EXCLUSIVE OR WITH HIGH BYTE
0015 A8                 XRA     B       ;EXCLUSIVE OR WITH MODIFIER
0016 BE                 CMP     M       ;COMPARE WITH MEMORY
0017 C22500             JNZ     EXIT    ;IF NOT EQUAL, GO TO EXIT
001A 23                 INX     H       ;INCREMENT ADDRESS
001B 7C                 MOV     A,H     ;LOAD HIGH BYTE OF ADDRESS
001C FE20               CPI     EPAGE   ;COMPARE WITH STOP ADDRESS
001E C21300             JNZ     TEST    ;IF NOT DONE, GO BACK TO 0013H
0021 04                 INR     B       ;INCREMENT B (PATTERN MODIFIER)
0022 C30200             JMP     LOOP    ;GO BACK AND FILL MEMORY WITH
                                        ; NEW PATTERN
                ;
                ;ERROR EXIT AND HALT
                ;
0025 222D00     EXIT:   SHLD    BYTE    ;SAVE ADDRESS OF BAD BYTE IN
                                        ; LOCATIONS 002DH & 002EH
0028 322C00             STA     PATRN   ;SAVE CORRECT PATTERN
002B 76                 HLT             ;HALT
002C            PATRN:  DS      1
002D            BYTE:   DS      2
002F 2F00       START:  DW      $
                ;
                ;NOTE:  THE CONTENTS OF LOCATIONS 000CH & 001DAH SHOULD
                ;       BE SELECTED ACCORDING TO THE FOLLOWINT MEMORY
                ;       SIZE TABLE
                ;
                ;MEMORY          MEMORY          VALUE OF LOCATIONS
                ;INSTALLED       TEST            000CH & 001DH OK
                ;                TIME            EPAGE EQU VALUE
                ;   4K                              10H
                ;   8K          2 MIN., 17 SEC.     20H
                ;  12K                              30H
                ;  16K                              40H
                ; ETC.
                ;
0020            EPAGE   EQU     20H     ;PROGRAM ASSEMBLED FOR 8K
0000                    END
                0
!
:1000000000600212F007DACA877237CFE20C20500CE
:1000100212F007DACA8BEC22500237CFE20C21388
:0C002000000C30200222D00322C0076E8
:02002F002F00A0
:00000001FF
```


Bits and Bytes
COMPUTER SHOP
IN
PHOENIX

AFFORDABLE — OFF THE SHELF

WE FEATURE the **EPA MICRO-68** and **EPA Expanded-68** microcomputers. These fine systems are based on the popular Motorola 6800.

WE FEATURE the **Micro-Term ACT-I** keyboard and **Sanyo** high resolution Video Monitor as a TTY replacement, for the lowest possible cost CRT.

ALSO . . . we sell a full line of EPA boards and µcomputer peripherals as well as a large selection of books and magazines.

OPEN EVENINGS AND WEEKENDS

6819 North 21st Avenue
Phoenix, Arizona 85015
(602) 242-2507

CIRCLE INQUIRY NO. 51

4K Low Power Static RAM Board
Kit $79.95

FULL HIGH IMPEDENCE BUFFERING • 4.5" x 6" WITH STD 44 PIN GOLD-PLATED EDGE CONNECTOR • MILITARY QUALITY PC BOARD WITH PLATED THROUGH HOLES • 450 NS. LOW POWER 2102 RAMS • ON-BOARD ADDRESS DECODING INCLUDES FULL DOCUMENTATION

6800 OEM Prototype Sets

PROTOTYPE BOARD (With Sockets) **42.50**
See September issue, p. 72 for details.

LOW COST 6800 STARTER SET
Includes board, sockets, 6800 CPU, 6810 RAM, 6820 PIA, address decoder, documentation for minimum system. **84.95**

NEW 1K RAMS at Surplus Prices **2102-1 1.55**
Check Date Codes and Compare

	Organization	Access Time	Price
RAM	1Kx1	450 ns 2102	1.55
	256x1	45 ns low pwr	3.90
PROMS	512x8	100 ns	20.00
	256x4	80 ns	3.00
E PROMS	256x8	1 ms	10.00

7 segment LED displays .3" high. Very bright 1 tube (25) 25.00
Octal and decimal decoder with 4 bit latch and constant current drivers for above displays 1.75

DISCOUNTS AVAILABLE AT OEM QUANTITIES

KATHRYN ATWOOD ENTERPRISES
P.O. BOX 5203
ORANGE, CA 92667

- Calif. Residents add 6 sales tax
- For total orders less than $25.00 add $1.25 shipping and handling

Estimated shipping time 7 days ARO

CIRCLE INQUIRY NO. 52

TEXT EDITOR FOR THE SWTPC-6800 (Program Symbolic Name: TEFT 6800)

by Mark Borgerson

Introduction

The following program is a general-purpose text editor designed to run in my SWTPC-6800 microcomputer. Your first question will probably be, "why write a text editor?" The answer is not really simple. I suppose a primary reason was simply because I wanted the programming experience. A second reason is that I intend to use the editor as the nucleus of a more complex word-processing system. The second element of that system, a program I call CIRS (for Cassette Information Retrieval System), has been written and will be the subject of a future article. The CIRS program automatically reads the text files produced with the editor and searches the files for keywords entered at the start of the search process. For instance, I can specify that I would like to see all files which contain either the name SMITH or JONES and the city name SAN FRANCISCO. If I had started with a cassette (built with the editor) containing files with the name, address and other information on all the people with whom I am corresponding, the appropriate files would be written on my CRT as they were found on the cassette. Files not containing the right combination of key words would be read in, searched and rejected without any output.

Text Editor Applications Orientated

The editor is also a fine tool for the preparation of text for other purposes. If you have a hard-copy terminal, you could prepare the club newsletter in a nice, error-free format (correcting the inevitable errors in memory, not on paper), then insert a ditto master and run off a perfect copy of the text for reproduction. With an IBM Selectric terminal, form letters individualized with new names and addresses would be greatly simplified. It would be a matter of simply composing the basic letter, outputting the first copy, then changing name and other information with the CHANGE command, and running off the next letter.

Most people trained on large computer systems tend to think of the text editor as a SYSTEMS program. That is, a program which is used to prepare other programs which actually do what you wanted to do in the first place. In other words, the editor is used to write the FORTRAN or assembly language program which will do the actual task. The examples I have given here show that the editor can also be a powerful APPLICATIONS program in its own right. For anyone interested in the manipulation of alphanumeric information (which is why we progressed from pocket calculators to computers) a text editor is a very powerful tool.

Text Editor Memory Requirements

The editor program itself is 1182_{10} bytes long, including reserved variable storage in page zero. The text editor runs from 0040_{16} to $04DE_{16}$. The lower 40_{16} bytes in page zero are reserved storage for other elements of my operating system. If you decide to customize the editor for your system, this is a good place to put short routines and pointers to your own cassette and I/O drivers. The program will run in the minimum 2K memory supplied with the SWTPC 6800 kit, but your buffer will be limited to 768 characters (a little over half a double-spaced typewritten page). With 4 or 8K of memory, the buffer can be large enough to work with fairly lengthy files. A memory size of 8K would allow you to work on files up to about 65 full lines of 72-character width. The text is stored in the buffer memory in compact form. Line numbers are not required, and deletion of lines causes the text to be moved in memory to conserve buffer space.

MIKBUG™ LINKAGE

To keep the editor as compact as possible, three I/O routines in the MIKBUG® ROM are used. These routines are INEE which inputs a character from the terminal to the A accumulator, OUTEE which outputs the character in the A accumulator to the terminal and PDATA1. This last routine outputs a character string pointed to by the INDEX register and terminated with a hex 04. This is the routine used to print the error messages and other character strings in the editor. If your system does not incorporate this ROM you will need to change the pointers to use your own I/O routines. More will be said about program customization later.

Program Execution

The program execution should begin at address 0100 (hex). It is generally wise to start with an EMPTY command to clear any random characters from the buffer. Otherwise, any PRINT command which will go past the end of the text you have input will output random characters until the first null is encountered. Program execution may be interrupted with the RESET button on SWTPC computers or a similar facility on other models. Restarting at address 0100 will continue execution with the text buffer intact. If you wish to interrupt the program from the keyboard, the SPARE command at address 008E may be set up to initiate a jump to your system monitor. Load 008E with 4D then 8F and 90 with the high and low portions of your monitor address. Now by entering the command MONITOR, you will jump to your monitor routines. The

following paragraphs describe how to adapt the editor to systems with different hardware configurations and includes a brief explanation of a few of the more complex routines in the text editor program.

Mass-Storage Characteristics

The program listed in this article was developed to use a National Multiplex digital cassette deck running at a tape speed of 3 i.p.s. for program storage. The serial interface in the computer is set up to read and write data at a 2400 baud rate. At this speed, the Editor files come awfully close together on the tape and manually locating a particular file can be somewhat tedious. For this reason, the program is designed to automatically search for files by name. This segment of the program depends on the software-controlled parity selection of the Motorola ACIA to separate the file names from the data in the file. I also felt that there were some advantages in saving fixed length files, so the SAVE command was written to dump the whole text buffer — even the empty part at the end if the file doesn't fill the buffer. With a high-speed cassette deck, it only takes a few seconds to dump or read an extra 200 or 300 bytes. If you are using a slower mass-storage device or are not using a separate serial interface for saving the files, you may wish to modify the editor to fit your system. Some examples of this type of program customization are shown in the following paragraphs.

Program Customization

1. Modification of SAVE command to record variable length files.

HEX ADDRESS	OLD OPCODE	NEW OPCODE	COMMENTS
04C5	9C 42	81 00	Check for null

Now instead of checking for the end of the buffer, you are checking for the first null. When the null is found, data output is terminated.

2. Modification of the READ and SAVE routines to use an AC-30 cassette interface for file storage. First modify the SAVE routine:

HEX ADDRESS	OLD OPCODE	NEW OPCODE	COMMENTS
04A3	86 08	86 12	Load "record on"
04A5	B7 8010	BD 017C	Output character
04A8	8D C6	01 01	Eliminate initialization
04AA	C6 02	C6 08	Increase startup delay
04B0	CB 04	01 01	Extra Chrs. not needed
04BC	8D AE	01 01	Eliminate initialization
04C9	C6 0A	C6 03	Sets delay length
04CB	86 03	86 13	"reader off" as EOF
04CF	5A	01	Not needed
04D0	26 FB	8D 8C	Trailer delay
04D2	86 04	86 14	Load "record off"
04D4	B7 8010	BD 017C	Output character

Now modify the serial output routine:

HEX OPCODE	OLD OPCODE	NEW COMMENTS	
047D	37	36	PSHA instead of PSHB
047E	F6 8010	BD 017C	Output via OUTEE
0481	C5 02	32 39	PULA and return

Next change the READ routine:

0430	C6 08	86 11	Load "reader on"
0432	F7 8010	BD 017C	Output character
0435	8D 39	01 01	Eliminate initialization
0445	8D 25	01 01	Eliminate initialization
0452	81 03	81 13	Check for "Reader off"
0458	F7 8010	BD 045E	Delay while motor stops

Now modify the serial input routine:

048A	37	01	PSHB not needed
048B	F6 8010	BD 0176	Use INPUT routine
048E	C5	39	Return

The Text Editor will now automatically save and read files through the AC-30 audio cassette interface at a 300 Baud rate. The terminal used with the interface must have reader/recorder control decoding for the process to be fully automated. Note that file names can no longer be distinguished from data on the basis of parity. To ensure that your file names don't occur in the data, simply add 3 or more X's to the name (e.g. SAVE/TESTXXX/). The resulting string is unlikely to occur in the data portion of the file. I suppose this modification could also be used to read and save files on paper tape if you are using a Teletype. At least I think it should work . . . I don't have one of those marvelous noisemakers connected to my computer. If you are using a TTY as your terminal, you may wish to do a more complete rewrite of the READ and SAVE routines and completely eliminate the named-file portions of the program.

Delete Characters & Insert Line Routines

There are two routines in the program that deserve more explanation than could be provided in the comments portion of the listing. The first of these is the DLTLIN subroutine which starts at line 295. The second routine is the MOVLIN subroutine at line 368. These two routines are used to shift large portions of the text in the buffer to accomplish the insertion or deletion of characters in the middle of the text buffer. I'll try to clarify the operation of these routines with an anology to a larger-scale physical process.

To clarify the DLTLIN routine, suppose we imagine the text buffer as a long row of post office type of open ended mail box pigeonholes. Each of the pigeonholes can store only one letter. The problem we face is the elimination of 10 letters in the middle of the row. Not only do we want to remove the 10 letters, but we also want to rearrange the rest of the letters so that no empty pigeonholes occur in the middle of the group of letters we are working with. Suppose we are at some arbitrary location in the middle of the row and need to eliminate the next 10 letters to our right (toward the "end" of the buffer). The way we accomplish this task is to reach out 10 letters (or pigeonholes) to the right, pick up the letter there and put it in the pigeonhole directly in front of us. This pushes the current letter out the back of the pigeonhole, thus eliminating it. Now we move one pigeonhole to the right, reach to the right 10 pigeonholes, pick up a letter and put it into the hole in front of us. This process is repeated until we reach the end of the row. At this time we have, in effect, pulled all the letters to the right of our starting point down 10 spaces, covering up and eliminating the

unwanted 10 letters. The pigeonhole letter deletion example shown in Fig. 1 shows pictorially the above process of letter deletion.

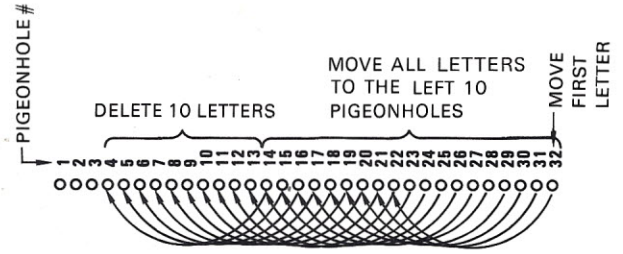


FIGURE 1. PIGEONHOLE LETTER DELETION EXAMPLE

In the program we are working with memory locations instead of mail box pigeonholes and ASCII characters instead of letters. Our starting point is set by loading the contents of CPNTR into the index register. The index register is used to define the pigeonhole we are in front of. The number of locations to reach ahead to fetch a character is defined by the byte stored at LENGTH. The "reaching ahead" is accomplished by storing this byte at DLET+1. This causes a character to be loaded into ACC A from a location (LENGTH) bytes ahead of the index location. The character is stored in front of us by storing it at the current index location. We then advance the index pointer and load another character, etc. etc..

The same anology can be used to explain the MOVLIN subroutine. The procedure here can be thought of as the opposite of the character deletion routine. Here we want to move all the characters ahead toward the end of the buffer to make room for some new ones. For this procedure it is easier to imagine that we start at the far right end of our row of pigeonholes. Suppose the last pigeonhole is number 100 and we need to make room for 10 new characters after pigeonhole 72, we start by subtracting 10 from 100. This tells us to start at pigeonhole 90. We now move to pigeonhole 90, pick up the letter in front of us, and put it in the hole 10 spaces to the right (number 100). We then move one space to the left, pick up the letter in front of us, put it in the hole 10 spaces to the right (number 99). This procedure is continued until we arrive at pigeonhole 73. When we arrive here, we note that we are nearly done, move one last letter (#73) and quit. There are now 10 empty holes just to our right! The pigeonhole insertion example shown in Fig. 2 shows pictorially the above process of making room for additional letters.

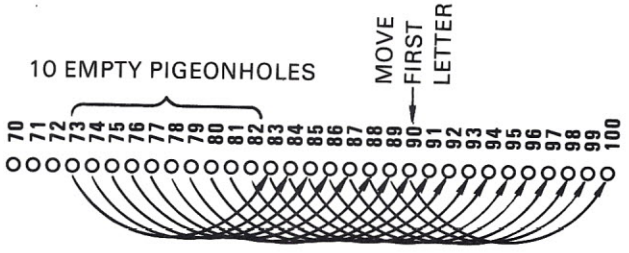


FIGURE 2. PIGEONHOLE INSERTION EXAMPLE

In our computer, the number of blank spaces to insert is stored at location LENGTH, and the index register is again used to mark our position in the buffer. Lines 368 to 372 accomplish the subtraction which will give us the starting location in the buffer. This location is then loaded into the index register. We accomplish the character movement by loading the character pointed to by the index register and storing it (LENGTH) positions ahead of the index location. The index is then decremented by one and the process repeated until the index is equal to the value stored at CPNTR and CPNTR+1. In the computer memory the 10 positions directly ahead of the CPNTR location will still contain their original contents, since reading the data from them does not change the contents.

I suppose there are other routines in the Editor program which also deserve a more complete explanation than is given in the program annotation. A particular example is the routine used to find a string in the buffer. Unfortunately, a full description of this routine would probably be long enough for an article in itself. If you really need full explanations of this type of routines, let the magazine editors know! If the demand is great enough, and the INTERFACE AGE magazine can provide space, I will write an article on this subject for publication. Feedback is vital to editors and authors.

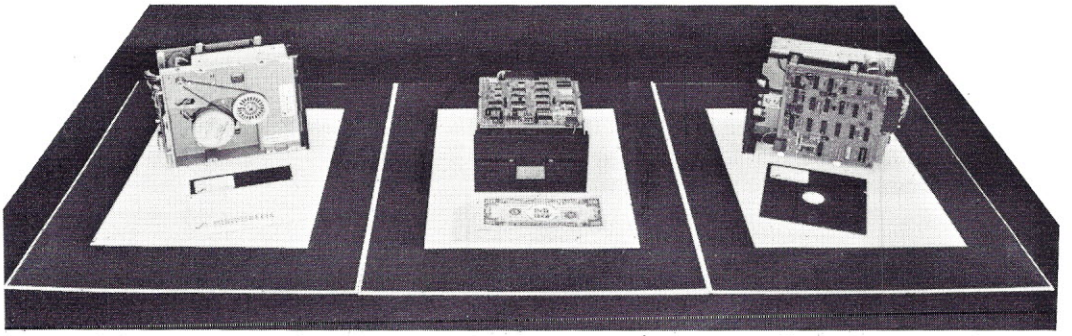
Text Editor Commands

The following table lists the commands which may be used with the text editor. Note that in those commands which allow a number to be specified, or which require a string to be specified, the command word must be separated from the number or string by one or more spaces. Any command may be abbreviated to its first letter followed by a space or a carriage return. If a carriage return immediately follows the command in a command requiring a number, the number will be assumed to be one. The editor will also assume the number is one if you forget the intervening space.

TEXT EDITOR COMMANDS

TOP	Sets line pointer to first character of first line in buffer.
BOTTOM	Sets line pointer to character position immediately after CR which ends last line present in buffer.
ERASE	Clears text buffer, sets pointer to top of buffer.
APPEND	Adds text to end of buffer. Text input should begin immediately after CR, LF sequence. No prompt character will be outputed to the terminal in this mode. Appended text is terminated with an ESC (Escape) character. The Editor will add a CR to the end of the text input.
NEXT *dd*	This command moves the editor

NOW THE HOBBY DISK IS HERE



$399

AT YOUR NEIGHBORHOOD BYTE SHOP COMPUTER STORE !!!

1063 W. El Camino Real
Mountain View, CA 94521
(415) 969-5464

2721 Hempstead Trnpk.
Levittown, NY 11756
(516) 731-8116

16508 Hawthorne Blvd.
Lawndale, CA 90260
(213) 371-2421

4 South Mission St.
Santa Barbara, CA 93101
(805) 966-2638

3464 South Acoma
Englewood, CO 80110
(303) 761-6232

1225 Ocean Street
Santa Cruz, CA 95060
(408) 425-1434

3400 El Camino Real
Santa Clara, CA 95051
(408) 249-4221

2559 S. Bascom Avenue
Campbell, CA 95008
(408) 377-4685

14300 Beach Blvd.
Westminster, CA 92683
(714) 894-9131

18424 Ventura Blvd.
Tarzana, CA 91356
(213) 343-3919

2033 S.W. 4th
Portland, OR 97201
(503) 223-3496

2227 El Camino Real
Palo Alto, CA 94306
(415) 327-8080

509 Francisco Boulevard
San Rafael, CA 94901
(415) 457-9311

813 N. Scottsdale Road
Tempe, AZ 85282
(602) 894-1120

2989 N. Main
Walnut Creek, CA 94956
(415) 933-6265

2040 30th Street
Boulder, CO 80301

8711 La Tierra Ave.
Westchester, CA 90045

5375 Kearny Villa Rd.
San Diego, CA

2705 Thousand Oaks Blvd.
Thousand Oaks, CA 91360
(805) 497-9595

1025 W. Lancaster Ave.
Bryn Mawr, PA 19010
(215) 525-7712

155 Blossom Hill Road
San Jose, CA 95123
(408) 226-8383

1514 University Ave.
Berkeley, CA 94703
(415) 845-6366

496 South Lake
Pasadena, CA 91101
(213) 684-3311

1434 Yankee Doodle Road
Eagan, MN 55121
(612) 452-1841

1200 W. Hillsdale Blvd.
San Mateo, CA 94403
(415) 341-4200

2018 Greene Street
Columbia, SC
(803) 771-7824

6041 Greenback Lane
Citrus Heights, CA 95610
(916) 726-2557

THE AFFORDABLE BYTE SHOP COMPUTER STORE

CIRCLE INQUIRY NO. 53

line pointer ahead or back by ***dd*** lines. Any number from 1 to 99 may be input as ***dd***. If ***dd*** is negative (e.g. -12) the line pointer will be moved toward the beginning of the buffer. If no number is given, the editor line pointer moves ahead one line.

PRINT ***dd*** Prints out ***dd*** lines of text on the control terminal, beginning at the current line pointer. After completion of the output, the line pointer remains at its original location. If no line number is given, one line is output.

DELETE ***dd*** Delete ***dd*** lines from the buffer, beginning with the current line. Text in the buffer after the deleted lines is moved to conserve memory space in the buffer.

INSERT Insert text before the current line. Text to be inserted is input after the CR, LF sequence. No prompt character will be outputed to the terminal. Text to be inserted is terminated with an ESC character. Multiple lines may be inserted with this command. If the last line of inserted text is not terminated with a CR, but with an ESC, this line will be inserted at the start of the line pointed to by the original line pointer. At the end of the INSERT operation the line pointer remains in its original position.

FIND/STRING/

Searches the text buffer from the current line pointer for the first occurrence of STRING. When the string is found, the line in which it occurs is outputed to the terminal. If the line is not found, the message "END OF TEXT REACHED" is outputed to the terminal and the line pointer remains in its original position. When the string is found, the line pointer is moved to the start of the line in which STRING occurs. The slash marks may be replaced by any printing ASCII character as delimiters.

CHANGE/STRING1/STRING2/

Searches the buffer from the current location for the first occurrence of STRING1. If the string is found, it is replaced with STRING2 and the modified line is outputed to the terminal. The line pointer is then moved to the start of this line. The two strings need not be the same length and the second string may be a null string. For example, the command string CHANGE/THX// would cause the first occurrence of the string THX to be deleted from the buffer. After a little practice, the CHANGE command can be used to perform extensive editing within the body of the text line without adding other commands specifically designed for character editing within a line. If the first character string in the command is not found, the "END OF TEXT REACHED" message is outputed to the terminal and the line pointer remains in its original position.

LENGTH dd Sets the number of 256-character pages in the text buffer. The routine does not check to see if you have enough RAM to accommodate the requested buffer size, so you have to exercise a little care in specifying buffers which will use most of your available RAM.

READ/FILENAME/

This command starts the cassette motor and looks for the cassette file which starts with FILENAME written in odd parity on the tape. The searching algorithm looks only for those characters in FILENAME and will not exclude files which contain additional characters in the name block. Thus, if you entered the name /TEST/, the editor would also accept "NEWTEST" or "OLDTEST" since each of these also contains the string "TEST" as part of the name. Files are entered into the buffer either until the end of the buffer is reached, or an End-of File character (hex 03) is read. The storage of the text in the buffer begins with the current position of the line pointer. This feature makes it possible to merge two or more files in the buffer with successive READ commands. Simply read the first file into memory, enter a BOTTOM command and read in the next file (manually rewinding the cassette if necessary).

Remember to enter a TOP command before the first file is read if you want it to start at the beginning of the buffer.

SAVE/FILENAME/

Transfers the contents of the text buffer to cassette tape. The routine is written to use an ACIA serial interface at address 8010(hex). The file name is written in odd parity and the data from the buffer in even parity. This allows the name-search subroutine in the READ command to differentiate between file names and data. As the routine is written, the entire buffer is written to the cassette (including a lot of nulls, if the file is short and the buffer is long). The simple two-byte modification discussed earlier will allow the production of variable-length files. The file name may be any length, with the limiation that the entire command must fit on one line.

See Microcomputer Software Depository Program Index for copies of this program.

```
      TEXT EDITOR FOR SWTPC-6800
      MARK BOWGERSON    OCTOBER,1976

00001                     NAM    EDITOR
00002                     OPT    O
00003                     OPT    S
00004                     OPT    NOG
00006 0040                ORG    $40
00007               * VARIABLE STORAGE IN PAGE 0
00008 0040 0002     TOPBUF RMB    2      CONTAINS LOC OF BUFFER START
00009 0042 0002     ENDBUF RMB    2      CONTAINS LOC OF BUFFER END
00010 0044 0002     TEMIDX RMB    2      TEMPORARY STORAGE LOCATIONS
00011 0046 0002     STKSTR RMB    2
00012 0048 0002     TEMBUF RMB    2
00013 004A 0001     LENGTH RMB    1
00014 004B 0001     NEGFLG RMB    1
00015 004C 0001     FLAG01 RMB    1
00016 004D 0001     DELIM  RMB    1
00017 004E 0002     CPNTR  RMB    2
00018 0050 0002     TBUF1  RMB    2
00019 0052 0002     TBUF2  RMB    2
00020               *END VARIABLE STORAGE
00021               * START MESSAGES AND BUFFERS
00022 0054 49       CMDERR FCC    /ILLEGAL COMMAND /
00023 0064 0A15           FDB    $0A15
00024 0066 04             FCB    4
00025               * THIS IS THE LOOKUP TABLE FOR COMMANDS
00026 0067 50       CMDTBL FCB    'P
00027 0068 017F           FDB    PRINT
00028 006A 4E             FCB    'N
00029 006B 01E0           FDB    NEXT
00030 006D 41             FCB    'A
00031 006E 02AB           FDB    APPEND
00032 0070 46             FCB    'F
00033 0071 036D           FDB    FIND
00034 0073 43             FCB    'C
00035 0074 0406           FDB    CHANGE
00036 0076 49             FCB    'I
00037 0077 02F7           FDB    INSERT
00038 0079 44             FCB    'D
00039 007A 0259           FDB    DELETE
00040 007C 54             FCB    'T
00041 007D 01C3           FDB    TOP
00042 007F 45             FCB    'E
00043 0080 01D6           FDB    EMPTY
00044 0082 42             FCB    'B
00045 0083 01C8           FDB    BOTTOM
00046 0085 53             FCB    'S
00047 0086 049B           FDB    SAVE
00048 0088 52             FCB    'R
00049 0089 0428           FDB    RDFIL
00050 008B 4C             FCB    'L
00051 008C 011D           FDB    SIZE
00052 008E 0000     SPARE  FDB    0
00053 0090 00             FCB    0
00054 0091 0D0A     CMDHDR FDB    $0D0A
00055 0093 153E           FDB    $153E
00056 0095 04             FCB    4
00057 0096 0048     LINBUF RMB    72
00058 00DE 1016     SIZMSG FDB    $1016
00059 00E0 0000           FDB    0
00060 00E2 45             FCC    /EDITOR V 1.5/
00061 00EE 0D0A           FDB    $0D0A
00062 00F0 0000           FDB    0
00063 00F2 42             FCC    /BUFFER SIZE? /
00064 00FF 04             FCB    4
00065 0100                ORG    $100
00066               * START PROGRAM BY SETTING BUFFER SIZE
00067 0100 CE 04DF        LDX    #PGEND+1    FIND END OF PROGRAM
00068 0103 DF 40          STX    TOPBUF      SAVE AS START OF BUFFER
00069 0105 DF 4E          STX    CPNTR       SAVE AS LINE POINTER
00070 0107 CE 00DE        LDX    #SIZMSG
00071 010A BD 0179        JSR    PDAT        PRINT MESSAGE
00072 010D CE 0097        LDX    #LINBUF+1
00073 0110 86 20          LDA A  #$20        SAVE A SPACE
00074 0112 A7 00          STA A  X
00075 0114 08       SIZE1 INX
00076 0115 8D 5F          BSR    INPUT       GET A DIGIT FOR SIZE
00077 0117 A7 00          STA A  X
00078 0119 81 0D          CMP A  #$0D        CHECK FOR CR
00079 011B 26 F7          BNE    SIZE1
00080 011D CE 0096  SIZE  LDX    #LINBUF     START AT BEGINNING OF CMD
00081 0120 BD 0210        JSR    GETNUM      EVALUATE THE NUMBER
00082 0123 DE 40          LDX    TOPBUF      GET START OF BUFFER
00083 0125 DF 42          STX    ENDBUF      SAVE AS END
00084 0127 7C 0042  INCSIZ INC    ENDBUF      ADVANCE END BY 256 FOR EACH
00085 012A 5A             DEC B               INCREMENT OF SIZE
00086 012B 26 FA          BNE    INCSIZ
00087 012D DE 42          LDX    ENDBUF
00088 012F 86 48          LDA A  #72         NOW CLEAR 72 LOCATIONS
00089 0131 6F 00    CLREND CLR    X           AFTER END OF BUFFER
00090 0133 08             INX
00091 0134 4A             DEC A
00092 0135 26 FA          BNE    CLREND
00093               * RESTART POINT...SET STACK POINTER
00094 0137 8E A060  START  LDS    #$A060      RESET STACK POINTER
00095 013A CE 0091  BEGIN  LDX    #CMDHDR
00096 013D BD 3A          BSR    PDAT        OUTPUT A PROMPT CHAR.
00097 013F CE 0096        LDX    #LINBUF
00098 0142 8D 32    GETCHR BSR    INPUT       CHECK FOR \
00099 0144 81 5C          CMP A  #'\         IF FOUND DELETE PRECEDING
00100 0146 26 03          BNE    CONT1       CHARACTER
00101 0148 09             DEX
00102 0149 20 F7          BRA    GETCHR
00103 014B 81 18    CONT1 CMP A  #$18        CHECK FOR "CANCEL"
00104 014D 27 EB          BEQ    BEGIN       IF FOUND START LINE OVER
00105 014F A7 00          STA A  X
00106 0151 08             INX
00107 0152 81 0D          CMP A  #$0D        CHECK FOR CR
00108 0154 26 EC          BNE    GETCHR      NOT CR, LOOP BACK
00109 0156 8D 4A          BSR    CRFUNC      OUTPUT CR, LF
00110               *BUFFER FILLED, FIND COMMAND
00111 0158 CE 0067        LDX    #CMDTBL     GET START OF TABLE
00112 015B 96 96          LDA A  LINBUF      GET FIRST CHAR OF CMD
00113 015D A1 00    COMPAR CMP A  X           CHECK FOR MATCH
00114 015F 27 0F          BEQ    GDCMD       IF MATCH, EXECUTE
00115 0161 08             INX                ADVANCE POINTER TO NEXT
00116 0162 08             INX                COMMAND
00117 0163 08             INX
00118 0164 8C 0091        CPX    #SPARE+3    CHECK END OF TABLE?
00119 0167 26 F4          BNE    COMPAR      NOT END, LOOP BACK
00120               * ERROR ROUTINE FOR ILLEGAL COMMAND
00121 0169 CE 0054  ERROR  LDX    #CMDERR     OUTPUT AN ERROR MESSAGE
00122 016C 8D 0B          BSR    PDAT        AND START OVER
00123 016E 20 C7          BRA    START
00124               *VALID CMD FOUND
00125 0170 EE 01    GDCMD  LDX    1,X         LOAD LOCATION OF ROUTINE
00126 0172 AD 00          JSR    X           AND EXECUTE AS SUBROUTINE
00127 0174 20 C4          BRA    BEGIN       GET NEXT COMMAND
00128               *POINTERS TO I/O ROUTINES
00129 0176 7E E1AC  INPUT  JMP    $E1AC       THESE I/O ROUTINES ARE PART
00130 0179 7E E07E  PDAT   JMP    $E07E       OF MIKBUG ROM FROM MOTOROLA
00131 017C 7E E1D1  OUTEE  JMP    $E1D1
00132               * PRINT N LINES OF TEXT FROM CURRENT
00133               * LOCATION IN BUFFER
00134 017F 8D 1A    PRINT  BSR    PAGE        A HOME-UP, CR, LF FOR TVT-II
00135 0181 BD 0210        JSR    GETNUM      EVALUATE THE NUMBER
00136 0184 DE 4E          LDX    CPNTR
00137 0186 A6 00    CHARLD LDA A  X
00138 0188 08             INX
00139 0189 81 0D          CMP A  #$0D     LOAD CHARACTERS & OUTPUT UNTIL
00140 018B 27 08          BEQ    DECLIN      A CR IS FOUND, THEN DECREMENT
00141 018D 81 00          CMP A  #0          COUNT. WHEN COUNT IS ZERO THE
00142 018F 27 2F          BEQ    PNT0ER      REQUIRED NUMBER OF LNES HAVE
00143 0191 8D 21          BSR    CHOUT       BEEN PRINTED.
00144 0193 20 F1          BRA    CHARLD
00145 0195 8D 0B    DECLIN BSR    CRFUNC
00146 0197 5A             DEC B
00147 0198 26 EC          BNE    CHARLD
00148 019A 39             RTS
00149               * TOP OF PAGE AND CR/LF ROUTINES
00150 019B 36       PAGE   PSH A
00151 019C 86 10          LDA A  #$10
00152 019E 8D 14          BSR    CHOUT       OUTPUT A HOME-UP
00153 01A0 20 01          BRA    CRFUNC+1
00154 01A2 36       CRFUNC PSH A
00155 01A3 86 0D          LDA A  #$0D
00156 01A5 8D 0D          BSR    CHOUT       OUTPUT A CARRIAGE RETURN
00157 01A7 86 0A          LDA A  #$0A
00158 01A9 8D 09          BSR    CHOUT       OUTPUT A LINE FEED
00159 01AB 86 15          LDA A  #$15
00160 01AD 8D 05          BSR    CHOUT       OUTPUT AN ERASE-TO-END-OF
00161 01AF 4F             CLR A              LINE
00162 01B0 8D 02          BSR    CHOUT       OUTPUT A NULL
00163 01B2 32             PUL A
00164 01B3 39             RTS
00165               *CHOUT SUBRTN
00166               * THIS OUTPUT ROUTINE CHECKS FOR BREAK
00167               * INPUT TO INTERRUPT OUTPUT
00168 01B4 BD 017C  CHOUT  JSR    OUTEE
00169 01B7 B6 8004        LDA A  $8004
00170 01BA 2B 03          BMI    CHRET
00171 01BC 7E 0137        JMP    START
00172 01BF 39       CHRET  RTS
00173               * POINTERS
00174 01C0 7E 027B  PNT0ER JMP    ET01
00175               * TOP COMMAND
00176 01C3 DE 40    TOP    LDX    TOPBUF      LOAD   BUFFER START
00177 01C5 DF 4E          STX    CPNTR       INTO LINE POINTER
00178 01C7 39             RTS
00179               *BOTTOM COMMAND
00180 01C8 DE 4E    BOTTOM LDX    CPNTR       STARTING AT CURRENT LOCATION
00181 01CA A6 00    BLOAD  LDA A  X           STEP THROUGH BUFFER LOOKING
00182 01CC 81 00          CMP A  #0          FOR A NULL--WHICH SIGNIFIES
00183 01CE 27 03          BEQ    BOT1        END OF TEXT.  SAVE  LOCATION
00184 01D0 08             INX                AS THE NEW LINE POINTER.
00185 01D1 20 F7          BRA    BLOAD
00186 01D3 DF 4E    BOT1   STX    CPNTR
00187 01D5 39             RTS
00188               *EMPTY COMMAND
00189 01D6 DE 40    EMPTY  LDX    TOPBUF      STEP THROUGH THE BUFFER FROM
00190 01D8 6F 00    CLR01  CLR    X           BEGINNING TO END, CLEARING
00191 01DA 08             INX                EACH LOCATION/
00192 01DB 9C 42          CPX    ENDBUF
00193 01DD 26 F9          BNE    CLR01
00194 01DF 39             RTS
00195               *NEXT COMMAND
00196 01E0 BD 0210  NEXT   JSR    GETNUM      EVALUATE THE NUMBER
00197 01E3 DE 4E          LDX    CPNTR
00198 01E5 86 0D          LDA A  #$0D
00199 01E7 7D 004B        TST    NEGFLG      CHECK FOR NEGATIVE NUMBER
00200 01EA 27 11          BEQ    LOOP1       FOR POSITIVE NO. START AT
00201 01EC 09             DEX                LOOP 1
00202 01ED 09       LOOP0  DEX
00203 01EE 9C 40          CPX    TOPBUF      MOVE BACK, CHECKING FOR END
00204 01F0 27 1B          BEQ    OVRRUN      AND DECREMENTING COUNT EACH
00205 01F2 A1 00          CMP A  X           TIME A CR IS FOUND
00206 01F4 26 F7          BNE    LOOP0       WHEN COUNT IS 0 POINTER IS
00207 01F6 5A             DEC B              MOVED BACK THE REQUIRED
00208 01F7 26 F4          BNE    LOOP0       NUMBER OF LINES
```

```
00209 01F9 08           INX
00210 01FA DF 4E        STX     CPNTR
00211 01FC 39           RTS
00212 01FD 08     LOOP1 INX
00213 01FF 9C 42        CPX     ENDBUF   ADVANCE POINTER, CHECKING END
00214 0200 27 0B        BEQ     OVRRUN   BUFFER AND DECREMENTING COUNT
00215 0202 A1 00        CMP A   X        EACH TIME A CR IS FOUND.
00216 0204 26 F7        BNE     LOOP1    WHEN COUNT REACHES 0 SAVE
00217 0206 5A           DEC B            POINTER
00218 0207 26 F4        BNE     LOOP1
00219 0209 08           INX
00220 020A DF 4E        STX     CPNTR
00221 020C 39           RTS
00222             * POINTER TO OVERFLOW ROUTINE
00223 020D 7E 02D4 OVRRUN JMP   ENDERR
00224             * SUBROUTINE TO GET A NUMBER FROM
00225             * THE COMMAND BUFFER...THE NUMBER
00226             * MAY RANGE FROM 1 TO 99.  THE  NUMBER
00227             * IS CONVERTED TO HEX AND SAVED IN ACC. B.
00228 0210 CE 0096 GETNUM LDX   #LINBUF
00229 0213 7F 004B      CLR     NEGFLG
00230 0216 08     INC0I INX              START CHECKING CMD BUFFER
00231 0217 A6 00        LDA A   X
00232 0219 81 0D        CMP A   #$0D     IF A CR IS FOUND BEFORE
00233 021B 27 36        BEQ     ONEOUT   A SPACE ASSUME NUMBER IS ONE
00234 021D 81 20        CMP A   #$20     WHEN SPACE IS FOUND START
00235 021F 26 F5        BNE     INC0I
00236 0221 08           INX
00237 0222 A6 00        LDA A   X        CHECKING FOR A MINUS SIGN
00238 0224 81 2D        CMP A   #'-      DIGIT IN ASCII FORM.
00239 0226 26 04        BNE     LDB      IF THE MINUS SIGN IS FOUND
00240 0228 7C 004B      INC     NEGFLG   SET FLAG
00241 022B 08           INX
00242 022C E6 01  LDB   LDA B   1,X       NOW LOAD THE DIGITS AND
00243 022E C0 30        SUB B   #$30     CONVERT TO NUMBERS IN ACC B
00244 0230 2B 16        BMI     NXTDGT   IF THE 2ND CHARACTER
00245 0232 C1 09        CMP B   #9       IS NOT A VALID NUMBER,
00246 0234 2E 12        BGT     NXTDGT   THEN ASSUME A 1-DIGIT NUMBER.
00247 0236 A6 00        LDA A   X        IF IT IS VALID, SAVE IT
00248 0238 80 30        SUB A   #$30      AND START ON  TENS DIGIT.
00249 023A 27 0B        BEQ     NUMKET
00250 023C 2B 18        BMI     GT0ERR   IF THIS DIGIT IS INVALID,
00251 023E 81 09        CMP A   #9       OUTPUT A MESSAGE.
00252 0240 2E 14        BGT     GT0ERR
00253 0242 CB 0A  ADLOOP ADD B  #10      NOW ADD 10 TO B FOR EACH
00254 0244 4A           DEC A            INCREMENT OF THE DIGIT IN A.
00255 0245 26 FB        BNE     ADLOOP
00256 0247 39      NUMKET RTS            RETURN WITH NUMBER IN ACC. B
00257 0248 E6 00  NXTDGT LDA B  X
00258 024A C0 30        SUB B   #$30     HERE WE PROCESS A 1-DIGIT
00259 024C 2B 08        BMI     GT0ERR   NUMBER, CHECKING FOR A VALID
00260 024E C1 09        CMP B   #9       DIGIT.
00261 0250 2F 04        BGT     GT0ERR
00262 0252 39           RTS
00263 0253 C6 01  ONEOUT LDA B  #1
00264 0255 39           RTS
00265             * ERROR ROUTINE POINTER
00266 0256 7E 0169 GT0ERR JMP   ERROR
00267             *DELETE ROUTINE
00268 0259 8D B5  DELETE BSR    GETNUM   EVALUATE # LINES TO DELETE
00269 025B DE 4E  DLINE LDX     CPNTR    START AT CURRENT LOCATION
00270 025D 7F 004A      CLR     LENGTH
00271 0260 A6 00  GETONE LDA A  X        NOW STEP AHEAD, CHECKING FOR
00272 0262 81 0D        CMP A   #$0D     FOR A CR OR A NULL.  AS YOU
00273 0264 27 0A        BEQ     LINEND   STEP AHEAD KEEP TRACK OF STEPS
00274 0266 81 00        CMP A   #0       BY INCREMENTING "COUNT"  .
00275 0268 27 0F        BEQ     ENDTXT   WHEN A CR IS FOUND COUNT WILL
00276 026A 7C 004A      INC     LENGTH   WILL CONTAIN THE LINE LENGTH
00277 026D 08           INX              IF YOU FIND A NULL, YOU HAVE
00278 026E 20 F0        BRA     GETONE   RUN OUT OF TEXT...OUTPUT
00279 0270 7C 004A LINEND INC   LENGTH   AN ERROR MESSAGE.
00280 0273 8D 25        BSR     DLTLIN   NOW JUMP TO A ROUTINE WHICH
00281 0275 5A           DEC B            WILL DELETE THE LINE,
00282 0276 26 E3        BNE     DLINE    THE LINE COUNT. IF IT IS
00283 0278 39           RTS              NOT 0 , DO IT OVER AGAIN.
00284 0279 8D 1F  ENDTXT BSR    DLTLIN   IF END TEXT--DELETE REMNANT.
00285             * ERROR ROUTINE FOR END TEXT REACHED
00286 027B CE 0284 ET01  LDX    #TXTMSG
00287 027E BD 0179      JSR     PDAT
00288 0281 7E 0137      JMP     START
00289             *END TEXT MESSAGE
00290 0284 0D0A   TXTMSG FDB    $0D0A
00291 0286 1500         FDB     $1500
00292 0288 45           FCC     /END TEXT REACHED /
00293 0299 04           FCB     4
00294             *CHARACTER DELETION ROUTINE
00295 029A DE 4E  DLTLIN LDX    CPNTR    START AT THE CURRENT LOCATION
00296 029C 96 4A        LDA A   LENGTH   DELETING AS MANY CHARACTERS
00297 029E B7 02A2      STA A   DLET+1   AS SPECIFIED BY  "LENGTH".
00298 02A1 A6 00  DLET  LDA A   X        OPERATION OF THIS ROUTINE IS
00299 02A3 A7 00        STA A   X        EXPLAINED IN ARTICLE TEXT.
00300 02A5 08           INX
00301 02A6 9C 42        CPX     ENDBUF
00302 02A8 26 F7        BNE     DLET
00303 02AA 39           RTS
00304             *APPEND ROUTINE
00305 02AB BD 01C8 APPEND JSR   BOTTOM   MOVE TO END OF TEXT
00306 02AE BD 0176 APP02  JSR   INPUT     AND ADD INPUT CHARACTERS
00307 02B1 81 5C        CMP A   #'\      DIRECTLY TO TEXT BUFFER.
00308 02B3 26 03        BNE     APP04    CHECK FOR BKSPACE (\) AS
00309 02B5 09           DEX              TEXT IS ENTERED.  TEXT
00310 02B6 20 F6        BRA     APP02    INPUT IS TERMINATED WITH'ESC'.
00311 02B8 81 1B  APP04 CMP A   #$1B
00312 02BA 26 08        BNE     STORE
00313 02BC 86 0D        LDA A   #$0D
00314 02BE A7 00        STA A   X
00315 02C0 08           INX

00316 02C1 DF 4E        STX     CPNTR
00317 02C3 39           RTS
00318 02C4 A7 00  STORE  STA A  X         THIS PART STORES THE INPUT
00319 02C6 08           INX
00320 02C7 9C 42        CPX     ENDBUF   AND CHECKS FOR THE END OF
00321 02C9 27 09        BEQ     ENDERR   THE BUFFER.  A CR ALSO
00322 02CB 81 0D        CMP A   #$0D     CAUSES A LF TO BE ECHOED
00323 02CD 26 DF        BNE     APP02    TO THE TERMINAL.
00324 02CF BD 01A2      JSR     CRFUNC
00325 02D2 20 DA        BRA     APP02
00326             * ERROR ROUTINE FOR END OF BUFFER
00327             * REACHED
00328 02D4 CE 02DD ENDERR LDX   #ENDMSG
00329 02D7 BD 0179      JSR     PDAT
00330 02DA 7E 0137      JMP     START
00331 02DD 0D0A   ENDMSG FDB    $0D0A
00332 02DF 45           FCC     /END OF BUFFER REACHED. /
00333 02F6 04           FCB     4
00334             *INSERT ROUTINE
00335 02F7 CE 0096 INSERT LDX   #LINBUF
00336 02FA 5F           CLR B
00337 02FB 7F 004C      CLR     FLAG01
00338 02FE BD 0176 INS01  JSR   INPUT    GET TEXT TO INSERT AND STORE
00339 0301 81 1B        CMP A   #$1B     IN LINE BUFFER, CHECKING FOR
00340 0303 26 05        BNE     INS02    AN 'ESC' OR CR.  ALSO CHECK
00341 0305 7C 004C      INC     FLAG01   FOR A 'CANCEL' OR BKSPACE.
00342 0308 20 1C        BRA     INS05
00343 030A 81 18  INS02 CMP A   #$18     CHECK CANCEL
00344 030C 26 05        BNE     INS03
00345 030E BD 01A2      JSR     CRFUNC
00346 0311 20 E4        BRA     INSERT
00347 0313 81 5C  INS03 CMP A   #'\      CHECK BACKSPACE.
00348 0315 26 04        BNE     INS04
00349 0317 5A           DEC B
00350 0318 09           DEX
00351 0319 20 E3        BRA     INS01
00352 031B 5C     INS04 INC B
00353 031C A7 00        STA A   X         STORE CHARACTER IN LINE
00354 031E 08           INX               BUFFER AND ADVANCE POINTER
00355 031F 81 0D        CMP A   #$0D
00356 0321 26 DB        BNE     INS01
00357 0323 BD 01A2      JSR     CRFUNC
00358 0326 D7 4A  INS05 STA B   LENGTH    SAVE  B AS LINE LENGTH
00359 0328 8D 0D        BSR     MOVLIN    NOW  MAKE ROOM IN BUFFER
00360 032A CE 0096      LDX     #LINBUF   GET POINTER TO NEW TEXT
00361 032D DF 48        STX     TEMBUF
00362 032F 8D 25        BSR     PUTBUF    INSERT NEW LINE INTO TEXT
00363 0331 7D 004C      TST     FLAG01    BUFFER AND CHECK FOR END
00364 0334 27 C1        BEQ     INSERT    OF INSERT OPERATION.
00365 0336 39           RTS
00366             * SUBROUTINE TO MOVE BUFFER AHEAD
00367             * TO MAKE ROOM FOR NEW LINE
00368 0337 96 42  MOVLIN LDA A  ENDBUF      THIS ROUTINE IS COVERED
00369 0339 D6 43        LDA B   ENDBUF+1     IN THE ARTICLE TEXT.
00370 033B D0 4A        SUB B   LENGTH
00371 033D 24 01        BCC     MOV02
00372 033F 4A           DEC A
00373 0340 97 44  MOV02 STA A   TEMIDX
00374 0342 D7 45        STA B   TEMIDX+1
00375 0344 DE 44        LDX     TEMIDX
00376 0346 08           INX
00377 0347 D6 4A        LDA B   LENGTH
00378 0349 F7 0350      STA B   MOV04+1
00379 034C 09     MOV03 DEX
00380 034D A6 00        LDA A   X
00381 034F A7 00  MOV04 STA A   X
00382 0351 9C 4E        CPX     CPNTR
00383 0353 26 F7        BNE     MOV03
00384 0355 39           RTS
00385             * SUBROUTINE TO TRANSFER CONTENTS OF
00386             * LINE BUFFER TO TEXT BUFFER.
00387 0356 9F 46  PUTBUF STS    STKSTR    SAVE SUBROUTINE STACK POINTER
00388 0358 9E 48        LDS     TEMBUF    USE STACK POINTER TO PULL TEXT
00389 035A 34           DES               FROM LINE BUFFER.
00390 035B D6 4A        LDA B   LENGTH    CHECK FOR NULL INSERT LINE.
00391 035D 27 0B        BEQ     PUTRET
00392 035F DE 4E        LDX     CPNTR
00393 0361 32     PULL1 PUL A             PULL A CHR. FROM LINE BUFFER
00394 0362 A7 00        STA A   X         STORE IN TEXT BUFFER
00395 0364 08           INX               ADVANCE POINTER
00396 0365 5A           DEC B             DECREMENT COUNTER
00397 0366 26 F9        BNE     PULL1     NOT 0, LOOP BACK
00398 0368 DF 4E        STX     CPNTR
00399 036A 9E 46  PUTRET LDS    STKSTR
00400 036C 39           RTS
00401             *FIND STRING ROUTINE
00402 036D CE 0096 FIND  LDX    #LINBUF
00403 0370 DF 50        STX     TBUF1
00404 0372 BD 03BE      JSR     DEFBUF    DEFINE STRING IN LINE BUFFER
00405 0375 BD 038A      JSR     MATCH     SEARCH FOR STRING IN TEXT
00406 0378 DE 4E  BKMOV LDX     CPNTR
00407 037A 86 0D        LDA A   #$0D
00408 037C 09     DECR  DEX               NOW MOVE BACK TO STARRT OF
00409 037D A1 00        CMP A   X         LINE AND PRINT OUT THE LINE
00410 037F 26 FB        BNE     DECR
00411 0381 08           INX
00412 0382 DF 4E        STX     CPNTR
00413 0384 C6 01        LDA B   #1
00414 0386 BD 0186      JSR     CHARLD
00415 0389 39           RTS
00416             *MATCH ROUTINE
00417 038A 9F 46  MATCH  STS    STKSTR    SAVE SUBROUTINE STACK
00418 038C DF 52        LDX     TBUF2     USE INDEX AS POINTER IN LINE
00419 038E 08           INX               BUFFER.

00420 038F 9E 4E        LDS     CPNTR     USE STACK POINTER  FOR
00421 0391 9F 4B        STS     NEGFLG    SEARCH IN TEXT BUFFER
00422 0393 D6 4A  GETLEN LDA B  LENGTH    GET LENGTH OF STRING TO
00423 0395 9F 44        STS     TEMIDX    MATCH.
00424 0397 32     PULLCH PUL A            PULL A CHARACTER FROM TEXT
00425 0398 81 00        CMP A   #0        CHECK FOR NULL(END TEXT)
00426 039A 27 19        BEQ     ENDSCH
00427 039C A1 00        CMP A   X         CHECK FOR MATCH
00428 039E 27 08        BEQ     FNDONE
00429 03A0 9E 44        LDS     TEMIDX    NOT A MATCH, ADVANCE
00430 03A2 DF 52        LDX     TBUF2     TEXT POINTER AND RESET
00431 03A4 31           INS               LINE POINTER
00432 03A5 08           INX
00433 03A6 20 EB        BRA     GETLEN
00434 03A8 D1 4A  FNDONE CMP B  LENGTH    CHECK FOR END OF MATCH
00435 03AA 26 02        BNE     FNDTWO
00436 03AC 9F 4E        STS     CPNTR      IF END , SAVE POINTER
00437 03AE 08     FNDTWO INX
00438 03AF 5A           DEC B             NOT END, DECREMENT COUNT
00439 03B0 26 E5        BNE     PULLCH     AND CHECK MORE CHARACTERS.
00440 03B2 9E 46  FOUND  LDS    STKSTR    RESTORE SUBROUTINE STACK
00441 03B4 39           RTS
00442             * ERROR ROUTINE FOR UNSUCCESSFUL SEARCH
00443 03B5 DE 4B  ENDSCH LDX    NEGFLG
00444 03B7 DF 4E        STX     CPNTR
00445 03B9 9E 46        LDS     STKSTR
00446 03BB 7E 027B      JMP     ET01
00447             * ROUTINE TO DEFINE A STRING IN
00448             * THE LINE BUFFER
00449 03BE DE 50  DEFBUF LDX    TBUF1
00450 03C0 08     INC03 INX
00451 03C1 A6 00        LDA A   X         START WITH 2ND CHARACTER OF
00452 03C3 81 20        CMP A   #$20      LINE BUFFER AND CHECK FOR
00453 03C5 27 06        BEQ     SPACE1    A SPACE.  IF CR COMES FIRST
00454 03C7 81 0D        CMP A   #$0D       THERE IS AN ERROR.
00455 03C9 27 21        BEQ     SYNERR
00456 03CB 20 F3        BRA     INC03
00457 03CD 08     SPACE1 INX
00458 03CE A6 00        LDA A   X         IGNORE EXTRA SPACES
00459 03D0 81 20        CMP A   #$20
00460 03D2 27 F9        BEQ     SPACE1
00461 03D4 97 4D        STA A   DELIM     FIRST NON-SPACE CHARACTER IS
00462 03D6 DF 52  C0ENT  STX    TBUF2     THE DELIMITER...SAVE IT.
00463 03D8 5F           CLR B
00464 03D9 08     INC04 INX               ADVANCE THROUGH LINE BUFFER
00465 03DA A6 00        LDA A   X         COUNTING CHARACTERS AND
00466 03DC 91 4D        CMP A   DELIM     LOOKING FOR 2ND DELIMITER.
00467 03DE 27 07        BEQ     ENDSTR    IF CR PRECEDES DELIMITER,
00468 03E0 81 0D        CMP A   #$0D      THERE IS AN ERRROR.
00469 03E2 27 08        BEQ     SYNERR
00470 03E4 5C           INC B
00471 03E5 20 F2        BRA     INC04
00472 03E7 DF 50  ENDSTR STX    TBUF1     SAVE LOCATION OF STRING END
00473 03E9 D7 4A        STA B   LENGTH    AND LENGTH OF STRING.
00474 03EB 39           RTS
00475             * ERROR ROUTINE FOR SYNTAX ERROR IN
00476             * DEFINITION OF STRING INPUT
00477 03EC CE 03F5 SYNERR LDX   #SYNMSG
00478 03EF BD 0179      JSR     PDAT
```

```
00479 03F2 7E 0137          JMP    START
00480 03F5 53       SYNMSG  FCC    /SYNTAX ERROR /
00481 0402 0D0A             FDB    $0D0A
00482 0404 1504             FDB    $1504
00483                *CHANGE ROUTINE
00484 0406 CE 0096  CHANGE  LDX    #LINBUF
00485 0409 DF 50            STX    TBUF1
00486 040B BD 03BE          JSR    DEFBUF   DEFINE OLD STRING
00487 040E BD 038A          JSR    MATCH    FIND IT IN TEXT BUFFER
00488 0411 BD 029A          JSR    DLTLIN   DELETE OLD STRING
00489 0414 DE 50            LDX    TBUF1
00490 0416 BD 03D6          JSR    C0ENT    DEFINE REPLACEMENT STRING
00491 0419 BD 0337          JSR    MOVLIN   MAKE ROOM FOR NEW STRING
00492 041C DE 52            LDX    TBUF2
00493 041E 08               INX
00494 041F DF 48            STX    TEMBUF
00495 0421 BD 0356          JSR    PUTBUF   PUT NEW STRININTO BUFFER
00496 0424 BD 0378          JSR    BKMOV    MOVE TO LINE START & PRINT
00497 0427 39               RTS
00498                *END CHANGE ROUTINE
00499                *
00500                * THE FOLLOWING CASSETTE I/O ROUTINES ARE
00501                * DESIGNED FOR A NATIONAL MULTIPLEX
00502                * DIGITAL CASSTTE RECORDER USING A
00503                * SERIAL INTERFACE AT ADDRESS $8010.
00504                * THE ROUTINES WRITE  FILE NAMES IN EVEN PARITY
00505                * TO DIFFERENTIATE THEM FROM DATA WHICH IS
00506                * WRITTEN IN ODD PARITY.
00507                *
00508                *READ FILE FROM CASSETTE
00509 0428 CE 0096 RDFIL  LDX    #LINBUF
00510 042B DF 50            STX    TBUF1
00511 042D BD 03BE          JSR    DEFBUF   DEFINE FILE NAME
00512 0430 C6 08            LDA B  #8       START CASSETTE MOTOR VIA
00513 0432 F7 8010          STA B  $8010    CONTROL OUTPUT ON ACIA
00514 0435 8D 39            BSR    EVENIT   INITIALIZE ACIA - EVEN PARITY
00515 0437 D6 4A    FDNAM   LDA B  LENGTH   START SEARCH FOR FILE NAME
00516 0439 DE 52            LDX    TBUF2
00517 043B 08       INCNAM  INX
00518 043C 8D 4C            BSR    SERIN
00519 043E A1 00            CMP A  X
00520 0440 26 F5            BNE    FDNAM
00521 0442 5A               DEC B
00522 0443 26 F6            BNE    INCNAM
00523 0445 8D 25            BSR    ODINIT
00524 0447 DE 4E            LDX    CPNTR    GET LOAD POINT FOR FILE
00525 0449 8D 3F    DATINP  BSR    SERIN    LOAD DATA INTO TEXT BUFFER
00526 044B A7 00            STA A  X
00527 044D 08               INX
00528 044E 9C 42            CPX    ENDBUF   CHECK FOR END OF BUFFER
00529 0450 27 04            BEQ    DATEND
00530 0452 81 03            CMP A  #3       OR END-OF-FILE FROM TAPE
00531 0454 26 F3            BNE    DATINP
00532 0456 C6 04    DATEND  LDA B  #4
00533 0458 F7 8010          STA B  $8010
00534 045B 7E 0137          JMP    START
00535 045E DF 44    DELAY   STX    TEMIDX   DELAY ROUTINE FOR TAPE
00536 0460 CE FFFF DLOOP    LDX    #$FFFF   MOTION CONTROL.
00537 0463 09       DECX    DEX
00538 0464 26 FD            BNE    DECX
00539 0466 5A               DEC B
00540 0467 26 F7            BNE    DLOOP
00541 0469 DE 44            LDX    TEMIDX
00542 046B 39               RTS
00543                *INITIALIZATION
00544 046C 86 04    ODINIT  LDA A  #4       INITIALIZATION FOR ACIA AT
00545 046E 20 01            BRA    INIT     LOCATION 8010(HEX)
00546 0470 4F       EVENIT  CLR A
00547 0471 C6 1B    INIT    LDA B  #$1B
00548 0473 F7 8010          STA B  $8010
00549 0476 C6 59            LDA B  #$59
00550 0478 1B               ABA
00551 0479 B7 8010          STA A  $8010
00552 047C 39               RTS
00553                *SERIAL IN AND OUT ROUTINES
00554 047D 37       SEROUT  PSH B
00555 047E F6 8010 LDSER    LDA B  $8010    CHECK FOR XMIT REGISTER EMPTY
00556 0481 C5 02            BIT B  #2
00557 0483 27 F9            BEQ    LDSER    LOOP BACK UNTIL EMPTY
00558 0485 B7 8011          STA A  $8011    STORE CHARACTER IN OUTPUT REG.
00559 0488 33               PUL B
00560 0489 39               RTS
00561 048A 37       SERIN   PSH B           SERIAL INPUT ROUTINE.
00562 048B F6 8010 SIN01    LDA B  $8010    CHECK FOR RCVD DATA READY
00563 048E C5 01            BIT B  #1
00564 0490 27 F9            BEQ    SIN01    LOOP BACK UNTIL READY
00565 0492 B6 8011          LDA A  $8011
00566 0495 C5 70            BIT B  #$70     IF CHARACTER HAS WRONG PARITY
00567 0497 26 F2            BNE    SIN01    OR OTHER ERROR, IGNORE IT.
00568 0499 33               PUL B
00569 049A 39               RTS
00570 049B CE 0096 SAVE     LDX    #LINBUF
00571 049E DF 50            STX    TBUF1
00572 04A0 BD 03BE          JSR    DEFBUF   DEFINE FILE NAME
00573 04A3 86 08            LDA A  #8       START MOTOR VIA ACIA CNTRL.
00574 04A5 B7 8010          STA A  $8010
00575 04A8 8D C6            BSR    EVENIT   INITIALIZE, EVEN PARITY
00576 04AA C6 02            LDA B  #2
00577 04AC 8D B0            BSR    DELAY    DELAY ABOUT 2 SECONDS
00578 04AE D6 4A            LDA B  LENGTH   GET LENGTH OF FILE NAME
00579 04B0 CB 04               ADD B  #4    ADD 4 TO LENGTH
00580 04B2 DE 52            LDX    TBUF2    EXTRA CHARACTERS  ALLOW
00581 04B4 08       OUTNAM  INX              TIME FOR PARITY CHANGE WHEN
00582 04B5 A6 00            LDA A  X        READING FILE.
00583 04B7 8D C4            BSR    SEROUT
00584 04B9 5A               DEC B
00585 04BA 26 F8            BNE    OUTNAM
00586 04BC 8D AE            BSR    ODINIT   CHANGE TO ODD PARITY.
00587 04BE DE 40            LDX    TOPBUF   START AT TOP OF BUFFER
00588 04C0 A6 00    DATOUT  LDA A  X
00589 04C2 8D B9            BSR    SEROUT
00590 04C4 08               INX              OUTPUT DATA UNTIL END REACHED
00591 04C5 9C 42            CPX    ENDBUF
00592 04C7 26 F7            BNE    DATOUT
00593 04C9 C6 0A            LDA B  #10
00594 04CB 86 03            LDA A  #3
00595 04CD 8D AE    EXTRA   BSR    SEROUT   OUTPUT 10 END-OF-FILE
00596 04CF 5A               DEC B            MARKS (HEX 03)
00597 04D0 26 FB            BNE    EXTRA
00598 04D2 86 04            LDA A  #4       STOP MOTOR VIA ACIA CONTROL
00599 04D4 B7 8010          STA A  $8010
00600 04D7 C6 02            LDA B  #2
00601 04D9 8D 83            BSR    DELAY    ALLOW TIME FOR MOTOR TO STOP
00602 04DB 7E 0137          JMP    START
00603                *END OF TAPE ROUTINES
00604 04DE 0D       PGEND   FCB    $0D      START BUFFER
00605                       END
```

Seasons Greetings

NOW TRY US!

The word is getting around ... the Byte Shop of Pasadena is a remarkable exception to the rule among computer stores. We offer a truly delightful environment supported by

* REAL courtesy
* REAL expertise
* EXPERT service
* GREAT classes
* EIGHT demo systems

and of course, a wide variety of low-priced computer hardware, software, tools and supplies. Come see what the happy rumors are all about ... then compare our store with ANY other!

THE AFFORDABLE BYTE SHOP COMPUTER STORE

The BYTE SHOP of Pasadena
496 South Lake Avenue
Pasadena, California 91101
Telephone: (213) 684-3311

- HOURS -
Tuesday - Saturday: 12 - 9
Sunday: 12 - 5
Monday: closed

Mastercharge Bankamericard
American Express

CIRCLE INQUIRY NO. 54

DR. WANG'S PALO ALTO TINY BASIC

By Roger Rauskolb

Tiny Basic was first proposed in Dr. Dobb's Journal. Li-Chen Wang's version of Palo Alto Tiny Basic originally appeared in Issue No. 5, May 1976 of Dr. Dobb's Journal. A complete listing was printed, but Dr. Wang did the assembly on an IBM computer and he defined different mnemonics. In order to assemble with an Intel Compatible Assembler a translation of most mnemonics had to be performed.

I had developed my own system, which consists of two small p.c. boards, one containing the 8080 CPU, 4k of 2708 type EROM and 1K of RAM. The other PCB contained the RS-232 Interface using the Intel 8251. So I wanted to change the I/O section.

If you want to change I/O, all routines are contained in the OUTC and CHKIO routines. My system uses the following configuration:

2708	EROMS	0000H	TO	07FFH
1k	OF RAM	1000H	TO	13FFH
8251	DATA PORT	0FAH		
8251	STATUS PORT			

Command Instruction 27H = 2 stop bits parity disabled. 8 bit characters. Baud Rate Factor of 04.

Mode Instruction 0CFH = No Hunt Mode. Not (RTS) forced to 0. Receive Enabled Data Terminal Ready Transmit Enabled.

Transmitter Ready Status Bit = Bit 0 (01H)
Receiver Buffer Ready Status Bit = Bit 1 (02H)

The program is contained in locations OOOOH to 0768H.

In 1K of RAM 847 bytes are left over for program.

Tiny Basic does not offer much in terms of functions and general mathematical capabilities. But it is great to teach programming basics to children (and adults) and for games, since it has the RND function. It takes up little memory space and executes a lot faster than other basics.

Dr. Wang was very helpful and assisted me all the way. Some errors were eliminated. I appreciate his help and he deserves a lot of credit for his implementation of Tiny Basic.

See Microcomputer Software Depository Program Index for Copies of this program.

THE TINY BASIC LANGUAGE

Numbers

In Tiny Basic, all numbers are integers and must be less than or equal to 32767.

Variables

There are 26 variables denoted by letters A through Z. There is also a single array @(1). The dimension of this array (i.e., the range of value of the index 1) is set automatically to make use of all the memory space that is left unused by the program. (i.e., 0 through SIZE/2, see SIZE function below.)

Functions

For the time being, there are only 3 functions:

ABS(X) gives the absolute value of X.

RND(X) gives a random number between 1 and X (inclusive).

SIZE gives the number of bytes left unused by the program.

Arithmetic and Compare Operators

/ divide. Note that since we have integers only, $\frac{2}{3}=0$.

* multiply.

− subtract.

+ add.

> compare if greater than.

< compare if less than.

= compare if equal to. Note than to certain versions of Basic "LET A=B=O" means "set both A and B to O". To this version of Tiny Basic, it means "set A to the result of comparing B with O".

compare if not equal to.

>= compare if greater than or equal to.

<= compare if less than or equal to.

+, −, *, and / operations result in a value of between −32767 and 32767. All compare operators result in a 1 if true and a 0 if not true.

Expressions

Expressions are formed with numbers, variables, and functions with arithmetic and compare operators between them. + and − signs can also be used at the beginning of an expression. The value of an expression is evaluated from left to right, except that * and / are always done first, and then + and −, and then compare operators. Parentheses can also be used to alter the order of evaluation.

Statements

A Tiny Basic statement consists of a statement

We've got it... You can get it

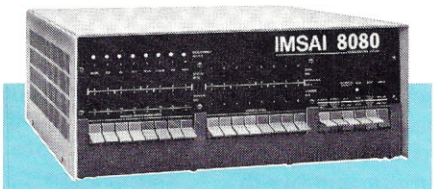
★ QUALITY Products ★ LOWEST Prices ★ FAST* Service



SOUTHWEST TECHNICAL PRODUCTS 6800
Basic Kit with 2 K of Ram

Mfgr.'s List Price	$395.00
OUR PRICE	374.95
add for:	
Shipping & Insurance	00.00
Tax	00.00
Your Cost	$374.95

We stock the complete line of SWTP Products. Please call or write for our catalog and price list. You can have the following SWTP options also: • T.V. Typewriter (CT#1024 kit) (259.95), complete with keyboard — cursor — power supply — interface etc. • Cassette Interface (AC-30 kit) (74.95) • Baud conversion kit (13.95).



IMSAI 8080

Mfgr.'s List Price	$599.00
OUR PRICE	558.00
add for:	
Shipping & Insurance	00.00
Tax	00.00
Your Cost	$558.00

We stock Imsai Ram Boards, interfaces, cables, etc., at similar discounts. Please call or write for our complete catalog and price list. SOME OPTIONS INCLUDE: • A 22 slot motherboard (51.00) • Cooling Fan (27.95 kit) • 1K of Ram (on board expandable to 4K) (57.95 kit) • 1K of Ram chips (for expanding board above) (32.49 kit) • Edge Connectors & Guide (for motherboard & Ram boards, interfaces etc.) (6.75 kit).



MICRO-TERM ACT-1 TERMINAL

Mfgr.'s List Price	$400.00
OUR PRICE	379.95
add for:	
Shipping & Insurance	00.00
Tax	00.00
Your Cost	$379.95

Fully Assembled
Features: • 64 characters • 110-9600 Baud • Auto scrolling • RS232c or current loop serial interface • Underline Cursor • 48 hour dynamic burn in. Teletype compatible serial I/O allows direct connection to 6800's, 8080's, & 8800's. 9" Sanyo high resolution monitor also available for $135.00 (shown).

(TERMS) *All orders will be shipped within 24 hrs. (one business day) from receipt of your order.** (We ship U.P.S. whenever possible). We pay all surface shipping and insurance charges to any point in the lower 48 states. **OUR QUANTITIES ARE LIMITED** — We will send you a notice by mail within 24 hrs. (one business day) of receipt of your order, indicating any items that are out of stock.

MCC
Montana Computer Center
(incorporated)
2512 Grand Avenue
Billings, Montana 59102
(406) 652-2177

**Certified check or money order assures prompt shipment and delivery. We are required to clear all personal checks. (Personal checks may take up to 3 weeks to clear.)

Stop in to see our new retail store, Billings, Montana at the intersection of I90 & I94 . . . Retail prices are slightly higher in our store.

YOU MUST INCLUDE THIS COUPON TO RECEIVE ABOVE PRICES

Rush me the following items:
- ☐ **IMSAI 8080 Kit** _____
- ☐ **SWTP 6800** _____
- ☐ **MICRO-TERM ACT-1** _____
- ☐ Information on above or below

OPTIONS (Please specify)
_____ _____
_____ _____
_____ _____

MCC Tax & Shipping 00.00
TOTAL ENCLOSED _____

Name _____
Address _____
City _____ State _____ Zip _____

Bank Cards (BAC & M.C. accepted)
☐ BankAmericard ☐ Master Charge
Acct. No. _____ Exp. Date _____
Signature _____

Montana Computer Center, 2512 Grand Avenue, Billings, Montana 59102

number between 1 and 32767 followed by one or more commands. Commands in the same statement are separated by a semi-colon ";". "GOTO", "STOP", and "RETURN" commands must be the last command in any given statement.

Program

A Tiny Basic program consists of one or more statements. When a direct command "RUN" is issued, the statement with the lowest statement number is executed first, then the one with the next lowest statement number, etc. However, the "GOTO", "GOSUB", "STOP", and "RETURN" commands can alter this normal sequence. Within the statement, execution of the commands is from left to right. The "IF" command can cause the execution of all the commands to its right in the same statement to be skipped over.

Commands

Tiny Basic commands are listed below with examples. Remember that commands can be concatenated with semi-colons. In order to store the statement, you must also have a statement number in front of the commands. The statement number and the concatenation are not shown in the examples.

REM or REMARK Command

REM anything goes
This line will be ignored by TBI.

LET Command

LET A=234−5*6, A=A/2, X=A−100, @(X+9)=A−1

will set the variable A to the value of the expression 234−5*6 (i.e., 204), set the variable A (again) to the value of the expression A/2 (i.e., 102), set the variable X to the value of the expression A-100 (i.e., 2), and then set the variable @(11) to 101 (where 11 is the value of the expression X+9 and 101 is the value of the expression A−1).

LET U=A#B, V=(A>B)*X+(A<B)*Y

will set the variable U to either 1 or 0 depending on whether A is not equal to or is equal to B; and set the variable V to either X, Y or 0 depending on whether A is greater than, less than, or equal to B.

PRINT Command

PRINT

will cause a carriage-return (CR) and a line-feed (LF) on the output device.

PRINT A*3+1, "ABC 123 !@#", ' CBA '

will print the value of the expression A*3+1 (i.e.,307), the string of characters "ABC 123 !@#", and the string " CBA ", and then a CR-LF. Note that either single or double quotes can be used to quote strings, but pairs must be matched.

PRINT A*3+1, "ABC 123 !@#", ' CBA ',

will produce the same output as before, except that there is no CR-LF after the last item is printed. This enables the program to continue printing on the same line with another "PRINT".

PRINT A, B, #3, C, D, E, #10, F, G

will print the values of A and B in 6 spaces, the values of C, D, and E in 3 spaces, and the values of F and G in 10 spaces. If there are not enough spaces specified for a given value to be printed, the value will be printed with enough spaces anyway.

PRINT 'ABC', ←, 'XXX'

will print the string "ABC", a CR without a LF, and then the string "XXX" (over the ABC) followed by a CR-LF.

INPUT Command

INPUT A, B

When this command is executed, Tiny Basic will print "A:" and wait to read in an expression from the input device. The variable A will be set to the value of this expression. Then "B:" is printed and variable B is set to the value of the next expression read from the input device. Note that not only numbers, but also expressions can be read as input.

INPUT 'WHAT IS THE WEIGHT'A, "AND SIZE"B

This is the same as the command above, except the prompt "A:" is replaced by "WHAT IS THE WEIGHT:" and the prompt "B:" is replaced by "AND SIZE:". Again, both single and double quotes can be used as long as they are matched.

INPUT A, 'STRING', ←, "ANOTHER STRING", B

The strings and the "←" have the same effect as in "PRINT".

IF Command

IF A<B LET X=3; PRINT 'THIS STRING'

will test the value of the expression A<B. If it is not zero (i.e., if it is true), the commands in the rest of this statement will be executed. If the value of the expression is zero (i.e., if it is not true), the rest of this statement will be skipped over and execution continues at next statement. Note that the word "THEN" is not used.

GOTO Command

GOTO 120

will cause the execution to jump to statement 120. Note that GOTO command cannot be followed by a semi-colon and other commands. It must be ended with a CR.

GOTO A*10+B

will cause the execution to jump to a different statement number as computed from the value of the expression.

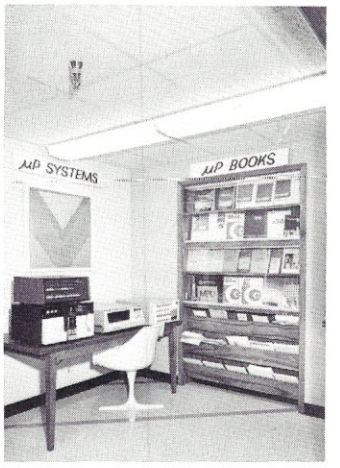
GOSUB and RETURN Commands

GOSUB command is similar to GOTO command

ANNOUNCING A NEW SOURCE FOR COMPUTERISTS







mpu *shop*

Semiconductor Specialists INC.

THE NATION'S LEADING SEMICONDUCTOR INDUSTRIAL DISTRIBUTOR

$AVE TIME **$AVE MONEY** Check Off Fill in Coupon Mail

Kits
- ☐ Martin 8080
- ☐ Motorola 6800
- ☐ RCA 1801/2
- ☐ Fairchild F8
- ☐ Mostek F8
- ☐ Signetics 2650
- ☐ TI SBPO400
- ☐ Other_____ specify

Chips
- ☐ TI 9900
- ☐ GI 1600
- ☐ Raytheon 2901
- ☐ Mostek Z80
- ☐ NEC 8080
- ☐ TI 8080
- ☐ RAMS_____ specify
- ☐ Other_____ specify

Accessories
- ☐ AP Products Breadboards and Testing Devices
- ☐ Vector Boards and Wire Wrap Tools
- ☐ Augat Boards and Sockets
- ☐ TI Sockets
- ☐ GE Terminal Strips
- ☐ Motorola Clocks
- ☐ DMC Power Supplies
- ☐ Other _____ specify

Send To: MPU Shop
c/o Semiconductor Specialists Inc.
195 Spangler Ave.
Elmhurst, IL 60126
(312) 279-1000

From:_____ name
_____ company
_____ address
_____ city, state, zip

Please send me information on the products checked above.

CIRCLE INQUIRY NO. 56

except that: a) the current statement number and position within the statement is remembered; and b) a semi-colon and other commands can follow it in the same statement.

GOSUB 120

will cause the execution to jump to statement 120.

GOSUB A*10+B

will cause the execution to jump to different statements as computed from the value of the expression A*10+B.

RETURN

A RETURN command must be the last command in a statement and followed by a CR. When a RETURN command is encountered, it will cause the execution to jump back to the command following the most recent GOSUB command.

GOSUB can be nested. The depth of nesting is limited only by the stack space.

LIST

will print out all the statements in numerical order.

LIST 120

will print out all the statements in numerical order 120.

NEW

will delete all the statements.

Stopping the Execution

The execution of program or listing of program can be stopped by the Control-C key on the input device.

Abbreviation and blanks

You may use blanks freely, except that numbers, command key words, and function names can not have embedded blanks.

You can truncate all command key words and function names and follow each by a period. "P.", "PR.", "PRI.", and "PRIN." all stand for "PRINT." Also the word LET in LET command can be omitted. The "shortest" abbreviation for all the key words are as follows:

A.=ABS	F.=FOR	GOS.=GOSUB	G.=GOTO
IF=IF	IN.=INPUT	L.=LIST	N.=NEW
N.=NEXT	P.=PRINT	REM=REMARK	R.=RETURN
R.=RND	R.=RUN	S.=SIZE	S.=STEP
S.=STOP	TO=TO		
Implied=LET			

Control of Output Device

The Control-O key on the input device can be used to turn the output device ON and OFF. This is useful when you want to read in a program punched on paper tape.

To produce such a paper tape, type "LIST" without CR. Turn on the paper tape punch and type a few Control-Shift-P's and then a CR. When listing is finished, type more Control-Shift-P's and turn off the punch.

To read back such a paper tape, type "NEW," CR, and Control-O, then turn on the paper tape reader. When the paper tape is finished, turn it off and type a Control-O again.

Control-Shift-P's and turn off the punch.

To read back such a paper tape, type "NEW," CR, and Control-?, then turn on the paper tape reader. When the paper tape is finished, turn it off and type a Control-O, then turn on the paper tape reader. When the paper tape is finished, turn it off and type a Control-O again.

Error Report

There are only three error conditions in TINY BASIC. The statement with the error is printed out with a question mark inserted at the point where the error is detected.

(1) WHAT? means it does not understand you. Example:

```
WHAT?  210 P?TINT "THIS"          where PRINT is mistyped

WHAT?  260 LET A=B+3, C=(3+4), X=4
```

(2) HOW? means it understands you but does not know how to do it.

```
HOW?   310LET A=B*C?+2   where B*C is larger than 32767

HOW?   380 GOTO 412?     where 412 dose not exist
```

(3) SORRY means it understands you and knows how to do it but there is not enough memory to do it.

Error Corrections

If you notice an error in typing before you hit the CR, you can delete the last character by the Rub-Out key or delete the entire line by the Alt-Mode key. Tiny basic will echo a back-slash for each Rub-Out. Echo for Alt-Mode consists of a LF, a CR, and an up-arrow.

To correct a statement, you can retype the statement number and the correct commands. Tiny Basic will replace the old statement with the new one.

To delete a statement, type the statement number and a CR only.

Verify the corrections by "LIST nnnn" and hit the Control-C key while the line is being printed.

FOR and NEXT Commands

FOR X=A+1 TO 3*B STEP C-1

The variable X is set to the value of the expression A+1. The values of the expressions (not the expressions themselves) 3*B and C-1 are remembered. The name of the variable X, the statement number and the position of this command within the statement are also remembered. Execution then continues the normal way until a NEXT command is encountered.

The STEP can be positive, negative or even zero. The word STEP and the expression following it can be omitted if the desired STEP is +1.

NEXT X

The name of the variable (X) is checked with that of the most recent FOR command. If they do not agree, that FOR is terminated and the next recent FOR is checked, etc. When a match is found, this variable will be set to its current value plus the value of the STEP expression saved by the FOR command. The updated

SUPER TERMINAL

Highest quality data communication terminals from a leading computer peripheral manufacturer.

AT AN AFFORDABLE PRICE

$700 to $1300 depending on options

Description

Terminal is a high speed USASCII keyboard/printing device operable at selected speeds of 10, 15, 30, 60 or 120 characters per second on dial-up or private communication networks. The printer design includes a dual paper path and removable tractor feed, easily facilitating both continuous forms (original and up to 5 copies) and single sheet paper.

Transmission

Speed	110, 150, 300, 600 or 1200 BPS
Code	ASCII 10-bit code
Interface	EIA Standard RS-232C

Printer

Type	Impact-original plus up to 5 copies Manifold print cartridge
Paper	Up to 14⅞" wide Continuous form or single sheet Automatic out-of-paper Interrupt
Forms Feed	Friction platen or Removable Tractor Feed Adjustable up to 14⅞" wide
Line Length	120 characters 10 characters/inch
Graphics	94 printable graphics ASCII standard character set
Line Feed	15 lines/second
Line Spacing	6 lines/inch
Print Speed	10, 15, 30, 60 or 120 CPS

Keyboard

60 keys
Generates full 128 ASCII characters
Two key rollover



Call or write for full details

COMPUTER COMPONENTS INC.

5848 Sepulveda Blvd.
Van Nuys CA 91411

(213) 786-7411

value is then compared with the value of the TO expression also saved by the FOR command. If this is within the limit, execution will jump back to the command following the FOR command. If this is outside the limit, execution continues following the NEXT command itself.

FOR can be nested. The depth of nesting is limited only by the stack space. If a new FOR command with the same control variable as that of an old FOR command is encountered, the old FOR will be terminated automatically.

STOP Command

STOP

This command stops the execution of the program and returns control to direct commands from the input device. It can appear many times in a program but must be the last command in any given statement, i.e., it cannot be followed by semi-colon and other commands.

Direct Commands

As defined earlier, a statement consists of a statement number followed by commands. If the statement number is missing, or if it is 0, the commands will be executed after you have typed the CR. All the commands described above can be used as direct commands. There are three more commands that can be used as direct command but not as part of a statement:

RUN

will start to execute the program starting at the lowest statement number.

See Microcomputer Software Depository Program Index for copies of this program.

```
;*************************************************************
;
;                TINY BASIC FOR INTEL 8080
;                     VERSION 2.0
;                   BY LI-CHEN WANG
;                 MODIFIED AND TRANSLATED
;                   TO INTEL MNEMONICS
;                   BY ROGER RAUSKOLB
;                    10 OCTOBER, 1976
;                       @COPYLEFT
;                  ALL WRONGS RESERVED
;
;*************************************************************
;
;   *** ZERO PAGE SUBROUTINES ***
;
;   THE 8080 INSTRUCTION SET LETS YOU HAVE 8 ROUTINES IN LOW
;   MEMORY THAT MAY BE CALLED BY RST N, N BEING 0 THROUGH 7.
;   THIS IS A ONE BYTE INSTRUCTION AND HAS THE SAME POWER AS
;   THE THREE BYTE INSTRUCTION CALL LLHH.  TINY BASIC WILL
;   USE RST 0 AS START AND RST 1 THROUGH RST 7 FOR
;   THE SEVEN MOST FREQUENTLY USED SUBROUTINES.
;   TWO OTHER SUBROUTINES (CRLF AND TSTNUM) ARE ALSO IN THIS
;   SECTION.  THEY CAN BE REACHED ONLY BY 3-BYTE CALLS.
;
DWA     MACRO  WHERE
        DB     (WHERE SHR 8) +128
        DB     WHERE AND 0FFH
        ENDM
0000            ORG  0H
        START:
0000 310014     LXI  SP,STACK ;*** COLD START ***
0003 3EFF       MVI  A,0FFH
0005 C34206     JMP  INIT
;
0008 E3         XTHL          ;*** TSTC OR RST 1 ***
0009 EF         RST  5        ;IGNORE BLANKS AND
000A BE         CMP  M        ;TEST CHARACTER
000B C36800     JMP  TC1      ;REST OF THIS IS AT TC1
;
000E 3E0D       CRLF: MVI  A,CR     ;*** CRLF ***
;
0010 F5         PUSH PSW      ;*** OUTC OR RST 2 ***
0011 3A0010     LDA  OCSW     ;PRINT CHARACTER ONLY
0014 B7         ORA  A        ;IF OCSW SWITCH IS ON
0015 C36C06     JMP  OC2      ;REST OF THIS IS AT OC2
;
0018 CD7103     CALL EXPR2    ;*** EXPR OR RST 3 ***
001B E5         PUSH H        ;EVALUATE AN EXPRESION
001C C32D03     JMP  EXPR1    ;REST OF IT IS AT EXPR1
;
001F 57         DB   'W'
;
0020 7C         MOV  A,H      ;*** COMP OR RST 4 ***
0021 BA         CMP  D        ;COMPARE HL WITH DE
0022 C0         RNZ           ;RETURN CORRECT C AND
0023 7D         MOV  A,L      ;Z FLAGS
0024 BB         CMP  E        ;BUT OLD A IS LOST
0025 C9         RET
0026 414E       DB   'AN'
;
0028 1A         SS1:  LDAX D      ;*** IGNBLK/RST 5 ***
0029 FE20       CPI  20H      ;IGNORE BLANKS
002B C0         RNZ           ;IN TEXT (WHERE DE->)
002C 13         INX  D        ;AND RETURN THE FIRST
002D C32800     JMP  SS1      ;NON-BLANK CHAR. IN A
;
0030 F1         POP  PSW      ;*** FINISH/RST 6 ***
0031 CDB304     CALL FIN      ;CHECK END OF COMMAND
0034 C3C604     JMP  QWHAT    ;PRINT "WHAT?" IF WRONG
0037 47         DB   'G'
;
0038 EF         RST  5        ;*** TSTV OR RST 7 ***
0039 D640       SUI  40H      ;TEST VARIABLES
003B D8         RC            ;C:NOT A VARIABLE
003C C25800     JNZ  TV1      ;NOT "@" ARRAY
003F 13         INX  D        ;IT IS THE "@" ARRAY
0040 CD1A04     CALL PARN     ;@ SHOULD BE FOLLOWED
0043 29         DAD  H        ;BY (EXPR) AS ITS INDEX
0044 DA9F00     JC   QHOW     ;IS INDEX TOO BIG?
0047 D5         PUSH D        ;WILL IT OVERWRITE
0048 EB         XCHG          ;TEXT?
0049 CD5904     CALL SIZE     ;FIND SIZE OF FREE
004C E7         RST  4        ;AND CHECK THAT
004D DAF404     JC   ASORRY   ;IF SO, SAY "SORRY"
0050 216613     LXI  H,VARBGN ;IF NOT, GET ADDRESS
0053 CD7C04     CALL SUBDE    ;OF @(EXPR) AND PUT IT
0056 D1         POP  D        ;IN HL
0057 C9         RET           ;C FLAG IS CLEARED
0058 FE1B       TV1:  CPI  1BH      ;NOT @. IS IT A TO Z?
005A 3F         CMC           ;IF NOT RETURN C FLAG
005B D8         RC
005C 13         INX  D        ;IF A THROUGH Z
005D 216613     LXI  H,VARBGN ;COMPUTE ADDRESS OF
0060 07         RLC           ;THAT VARIABLE
0061 85         ADD  L        ;AND RETURN IT IN HL
0062 6F         MOV  L,A      ;WITH C FLAG CLEARED
0063 3E00       MVI  A,0
0065 8C         ADC  H
0066 67         MOV  H,A
0067 C9         RET
;
;                    TSTC   XCH  HL,(SP)   *** TSTC OR RST 1 ***
;                           IGNBLK         THIS IS AT LOC. 8
;                           CMP  M         AND THEN JMP HERE
0068 23         TC1:  INX  H        ;COMPARE THE BYTE THAT
0069 CA7200     JZ   TC2      ;FOLLOWS THE RST INST.
006C C5         PUSH B        ;WITH THE TEXT (DE->)
006D 4E         MOV  C,M      ;IF NOT =, ADD THE 2ND
006E 0600       MVI  B,0      ;BYTE THAT FOLLOWS THE
0070 09         DAD  B        ;RST TO THE OLD PC
0071 C1         POP  B        ;I.E., DO A RELATIVE
0072 1B         DCX  D        ;JUMP IF NOT =
0073 13         TC2:  INX  D        ;IF =, SKIP THOSE BYTES
0074 23         INX  H        ;AND CONTINUE
0075 E3         XTHL
0076 C9         RET
;
        TSTNUM:
0077 210000     LXI  H,0      ;*** TSTNUM ***
007A 44         MOV  B,H      ;TEST IF THE TEXT IS
007B EF         RST  5        ;A NUMBER
007C FE30       TN1:  CPI  30H      ;IF NOT, RETURN 0 IN
007E D8         RC            ;B AND HL
007F FE3A       CPI  3AH      ;IF NUMBERS, CONVERT
0081 D0         RNC           ;TO BINARY IN HL AND
0082 3EF0       MVI  A,0F0H   ;SET A TO # OF DIGITS
0084 A4         ANA  H        ;IF >255, THERE IS NO
0085 C29F00     JNZ  QHOW     ;ROOM FOR NEXT DIGIT
0088 04         INR  B        ;B COUNTS # OF DIGITS
0089 C5         PUSH B
008A 44         MOV  B,H      ;HL=10*HL+(NEW DIGIT)
008B 4D         MOV  C,L
008C 29         DAD  H        ;WHERE 10* IS DONE BY
008D 29         DAD  H        ;SHIFT AND ADD
008E 09         DAD  B
008F 29         DAD  H
0090 1A         LDAX D        ;AND (DIGIT) IS FROM
0091 13         INX  D        ;STRIPPING THE ASCII
0092 E60F       ANI  0FH      ;CODE
0094 85         ADD  L
0095 6F         MOV  L,A
0096 3E00       MVI  A,0
0098 8C         ADC  H
0099 67         MOV  H,A
009A C1         POP  B
009B 1A         LDAX D        ;DO THIS DIGIT AFTER
009C F27C00     JP   TN1      ;DIGIT. S SAYS OVERFLOW
009F D5         QHOW:  PUSH D       ;*** ERROR: "HOW?" ***
00A0 11A600     AHOW:  LXI  D,HOW
00A3 C3CA04     JMP  ERROR
00A6 484F573F HOW:   DB   'HOW?'
00AA 0D         DB   CR
00AB 4F4B       OK:   DB   'OK'
00AD 0D         DB   CR
00AE 57484154 WHAT:  DB   'WHAT?'
00B2 3F
00B3 0D         DB   CR
00B4 534F5252 SORRY: DB   'SORRY'
00B8 59
00B9 0D         DB   CR
;
;*************************************************************
;
;  *** MAIN ***
;
;  THIS IS THE MAIN LOOP THAT COLLECTS THE TINY BASIC PROGRAM
;  AND STORES IT IN THE MEMORY.
;
;  AT START, IT PRINTS OUT "(CR)OK(CR)", AND INITIALIZES THE
;  STACK AND SOME OTHER INTERNAL VARIABLES.  THEN IT PROMPTS
;  ">" AND READS A LINE.  IF THE LINE STARTS WITH A NON-ZERO
;  NUMBER, THIS NUMBER IS THE LINE NUMBER.  THE LINE NUMBER
;  (IN 16 BIT BINARY) AND THE REST OF THE LINE (INCLUDING CR)
;  IS STORED IN THE MEMORY.  IF A LINE WITH THE SAME LINE
;  NUMBER IS ALREADY THERE, IT IS REPLACED BY THE NEW ONE.  IF
;  THE REST OF THE LINE CONSISTS OF A CR ONLY, IT IS NOT STORED
;  AND ANY EXISTING LINE WITH THE SAME LINE NUMBER IS DELETED.
;
;  AFTER A LINE IS INSERTED, REPLACED, OR DELETED, THE PROGRAM
;  LOOPS BACK AND ASKS FOR ANOTHER LINE.  THIS LOOP WILL BE
;  TERMINATED WHEN IT READS A LINE WITH ZERO OR NO LINE
;  NUMBER; AND CONTROL IS TRANSFERRED TO "DIRECT".
;
```

XIMEDIA PRESENTS

The SOROC IQ 120

CURSOR CONTROL
Forespace, backspace, up, down, new line, return, home, tab, PLUS ABSOLUTE CURSOR ADDRESSING.

TRANSMISSION MODES
Conversation (half & full Duplex) PLUS BLOCK MODE - transmit a page at a time.

FIELD PROTECTION
Any part of the display can be "protect ed" to prevent overtyping. Protected fields are displayed at reduced intensity.

EDITING
Clear screen, typeover, absolute cursor addressing, erase to end of page, erase to end of line, erase to end of field.

DISPLAY FORMAT
24 lines by 80 characters. (1920 characters)

CHARACTER SET
96 Characters total. Upper and lower case ASCII.

KEYBOARD
73 keys including numeric key pad.

REPEAT KEY
15 cps repeat action.

DATA RATES
Thumb wheel selectable from 75 to 19,200 Baud.

SCREEN
12" Rectangular CRT - P4 Phosphor.



SPECIAL INTRODUCTORY PRICING

KIT $995.00
ASSEMBLED $1295.00

XIMEDIA REPRESENTS

IMSAI	TDL
CROMEMCO	POLYMORPHIC
OLIVER	INFO-TECH
TARBELL	SWTP
MINITERM	SOROC
XMC	

XIMEDIA

(415) 566-7472

Please call collect!

1251 - 25th Avenue
San Francisco, California 94122

CHRISTMAS SPECIAL

10% discount on the LIST price of all items (except SOROC) ordered before January 15, 1977.

Write or call us today for more information on this great new product from SOROC TECHNOLOGY.

BANKAMERICARD & MASTERCHARGE ACCEPTED. PLEASE INCLUDE ALL NUMBERS AND EXPIRATION DATE.

California residents add 6% Sales Tax.
Please allow 3 weeks for delivery.

WATCH FOR THE COMPUTERIST™ - OUR UNIQUE NEW COMPUTER STORE. OPENING SOON IN SAN FRANCISCO, LOS ANGELES, AND SAN DIEGO.

CIRCLE INQUIRY NO. 58

```
                ; TINY BASIC PROGRAM SAVE AREA STARTS AT THE MEMORY LOCATION
                ; LABELED "TXTBGN" AND ENDS  AT "TXTEND".  WE ALWAYS FILL THIS
                ; AREA STARTING AT "TXTBGN", THE UNFILLED PORTION IS POINTED
                ; BY THE CONTENT OF A MEMORY LOCATION LABELED "TXTUNF".
                ;
                ; THE MEMORY LOCATION "CURRNT" POINTS TO THE LINE NUMBER
                ; THAT IS CURRENTLY BEING INTERPRETED.  WHILE WE ARE IN
                ; THIS LOOP OR WHILE WE ARE INTERPRETING A DIRECT COMMAND
                ; (SEE NEXT SECTION), "CURRNT" SHOULD POINT TO A 0.
                ;
                ;               RSTART LODI SP,STACK
                RSTART:
00BA 310014             LXI  SP,STACK
00BD CD0E00     ST1:    CALL CRLF       ;AND JUMP TO HERE
00C0 11AB00             LXI  D,OK       ;DE->STRING
00C3 97                 SUB  A          ;A=0
00C4 CD6005             CALL PRTSTG     ;PRINT STRING UNTIL CR

00C7 21CE00             LXI  H,ST2+1    ;LITERAL 0
00CA 220110             SHLD CURRNT     ;CURRNT->LINE # = 0
00CD 210000     ST2:    LXI  H,0
00D0 220910             SHLD LOPVAR
00D3 220310             SHLD STKGOS
00D6 3E3E       ST3:    MVI  A,3EH      ;PROMPT '>' AND
00D8 CDFA04             CALL GETLN      ;READ A LINE
00DB D5                 PUSH D          ;DE->END OF LINE
00DC 119D13             LXI  D,BUFFER   ;DE->BEGINNING OF LINE
00DF CD7700             CALL TSTNUM     ;TEST IF IT IS A NUMBER
00E2 EF                 RST  5
00E3 7C                 MOV  A,H        ;HL=VALUE OF THE # OR
00E4 B5                 ORA  L          ;0 IF NO # WAS FOUND
00E5 C1                 POP  B          ;BC->END OF LINE
00E6 CA3807             JZ   DIRECT
00E9 1B                 DCX  D          ;BACKUP DE AND SAVE
00EA 7C                 MOV  A,H        ;VALUE OF LINE # THERE
00EB 12                 STAX D
00EC 1B                 DCX  D
00ED 7D                 MOV  A,L
00EE 12                 STAX D
00EF C5                 PUSH B          ;BC,DE->BEGIN, END
00F0 D5                 PUSH D
00F1 79                 MOV  A,C
00F2 93                 SUB  E
00F3 F5                 PUSH PSW        ;A=# OF BYTES IN LINE
00F4 CD3805             CALL FNDLN      ;FIND THIS LINE IN SAVE
00F7 D5                 PUSH D          ;AREA, DE->SAVE AREA
00F8 C20B01             JNZ  ST4        ;NZ:NOT FOUND, INSERT
00FB D5                 PUSH D          ;Z:FOUND, DELETE IT
00FC CD5405             CALL FNDNXT     ;FIND NEXT LINE
                                                DE->NEXT LINE
00FF C1                 POP  B          ;BC->LINE TO BE DELETED
0100 2A1510             LHLD TXTUNF     ;HL->UNFILLED SAVE AREA
0103 CDE505             CALL MVUP       ;MOVE UP TO DELETE
0106 60                 MOV  H,B        ;TXTUNF->UNFILLED AREA
0107 69                 MOV  L,C
0108 221510             SHLD TXTUNF     ;UPDATE
010B C1         ST4:    POP  B          ;GET READY TO INSERT
010C 2A1510             LHLD TXTUNF     ;BUT FIRST CHECK IF
010F F1                 POP  PSW        ;THE LENGTH OF NEW LINE
0110 E5                 PUSH H          ;IS 3 (LINE # AND CR)
0111 FE03               CPI  3          ;THEN DO NOT INSERT
0113 CABA00             JZ   RSTART     ;MUST CLEAR THE STACK
0116 85                 ADD  L          ;COMPUTE NEW TXTUNF
0117 6F                 MOV  L,A
0118 3E00               MVI  A,0
011A 8C                 ADC  H
011B 67                 MOV  H,A        ;HL->NEW UNFILLED AREA
011C 116613             LXI  D,TXTEND   ;CHECK TO SEE IF THERE

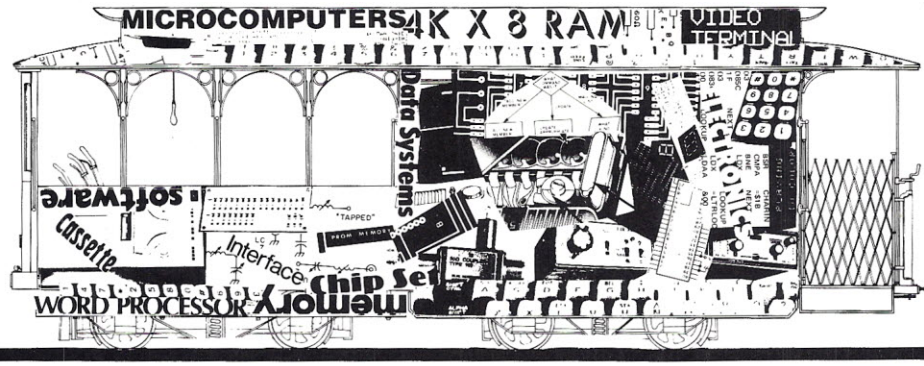
011F E7                 RST  4          ;IS ENOUGH SPACE
0120 D2F304             JNC  QSORRY     ;SORRY, NO ROOM FOR IT
0123 221510             SHLD TXTUNF     ;OK, UPDATE TXTUNF
0126 D1                 POP  D          ;DE->OLD UNFILLED AREA
0127 CDEE05             CALL MVDOWN
012A D1                 POP  D          ;DE->BEGIN, HL->END
012B E1                 POP  H
012C CDE505             CALL MVUP       ;MOVE NEW LINE TO SAVE
012F C3D600             JMP  ST3        ;AREA

                ;*****************************************************************
                ;
                ; WHAT FOLLOWS IS THE CODE TO EXECUTE DIRECT AND STATEMENT
                ; COMMANDS.  CONTROL IS TRANSFERED TO THESE POINTS VIA THE
                ; COMMAND TABLE LOOKUP CODE OF 'DIRECT' AND 'EXEC' IN LAST
                ; SECTION.  AFTER THE COMMAND IS EXECUTED, CONTROL IS
                ; TRANSFERED TO OTHER SECTIONS AS FOLLOWS:
                ;
                ; FOR 'LIST', 'NEW', AND 'STOP': GO BACK TO 'RSTART'
                ; FOR 'RUN': GO EXECUTE THE FIRST STORED LINE IF ANY; ELSE
                ; GO BACK TO 'RSTART'.
                ; FOR 'GOTO' AND 'GOSUB': GO EXECUTE THE TARGET LINE.
                ; FOR 'RETURN' AND 'NEXT': GO BACK TO SAVED RETURN LINE.
                ; FOR ALL OTHERS: IF 'CURRNT' -> 0, GO TO 'RSTART', ELSE
                ; GO EXECUTE NEXT COMMAND.  (THIS IS DONE IN 'FINISH'.)
                ;
                ;*****************************************************************
                ;
                ; *** NEW *** STOP *** RUN (& FRIENDS) *** & GOTO ***
                ;
                ; 'NEW(CR)' SETS 'TXTUNF' TO POINT TO 'TXTBGN'
                ;
                ; 'STOP(CR)' GOES BACK TO 'RSTART'
                ;
                ; 'RUN(CR)' FINDS THE FIRST STORED LINE, STORE ITS ADDRESS (IN
                ; 'CURRNT'), AND START EXECUTE IT.  NOTE THAT ONLY THOSE
                ; COMMANDS IN TAB2 ARE LEGAL FOR STORED PROGRAM.
                ;
                ; THERE ARE 3 MORE ENTRIES IN 'RUN':
                ; 'RUNNXL' FINDS NEXT LINE, STORES ITS ADDR. AND EXECUTES IT.
                ; 'RUNTSL' STORES THE ADDRESS OF THIS LINE AND EXECUTES IT.
                ; 'RUNSML' CONTINUES THE EXECUTION ON SAME LINE.
                ;
                ; 'GOTO EXPR(CR)' EVALUATES THE EXPRESSION, FIND THE TARGET
                ; LINE, AND JUMP TO 'RUNTSL' TO DO IT.
                ;
0132 CDC204     NEW:    CALL ENDCHK     ;*** NEW(CR) ***
0135 211710             LXI  H,TXTBGN
0138 221510             SHLD TXTUNF

013B CDC204     STOP:   CALL ENDCHK     ;*** STOP(CR) ***
013E C3BA00             JMP  RSTART
                ;
0141 CDC204     RUN:    CALL ENDCHK     ;*** RUN(CR) ***
0144 111710             LXI  D,TXTBGN   ;FIRST SAVED LINE
                ;
                RUNNXL:
0147 210000             LXI  H,0        ;*** RUNNXL ***
014A CD4005             CALL FNDLP      ;FIND WHATEVER LINE #
014D DABA00             JC   RSTART     ;C:PASSED TXTUNF, QUIT
                ;
                RUNTSL:
0150 EB                 XCHG            ;*** RUNTSL ***
0151 220110             SHLD CURRNT     ;SET 'CURRNT'->LINE #
0154 EB                 XCHG
0155 13                 INX  D          ;BUMP PASS LINE #
0156 13                 INX  D
                ;
                RUNSML:
0157 CD8406             CALL CHKIO      ;*** RUNSML ***
015A 21BD06             LXI  H,TAB2-1   ;FIND COMMAND IN TAB2
015D C33B07             JMP  EXEC       ;AND EXECUTE IT
                ;
0160 DF         GOTO:   RST  3          ;*** GOTO EXPR ***
0161 D5                 PUSH D          ;SAVE FOR ERROR ROUTINE
0162 CDC204             CALL ENDCHK     ;MUST FIND A CR
0165 CD3805             CALL FNDLN      ;FIND THE TARGET LINE
0168 C2A000             JNZ  AHOW       ;NO SUCH LINE #
016B F1                 POP  PSW        ;CLEAR THE "PUSH DE"
016C C35001             JMP  RUNTSL     ;GO DO IT
                ;
                ;*****************************************************************
                ;
                ; *** LIST *** & PRINT ***
                ;
                ; LIST HAS TWO FORMS:
                ; 'LIST(CR)' LISTS ALL SAVED LINES
                ; 'LIST #(CR)' START LIST AT THIS LINE #
                ; YOU CAN STOP THE LISTING BY CONTROL C KEY
                ;
                ; PRINT COMMAND IS 'PRINT ....;' OR 'PRINT ....(CR)'
                ; WHERE '....' IS A LIST OF EXPRESIONS, FORMATS, BACK-
                ; ARROWS, AND STRINGS.  THESE ITEMS ARE SEPERATED BY COMMAS.
                ;
                ; A FORMAT IS A FOUND SIGN FOLLOWED BY A NUMBER.  IT CONTROLS
                ; THE NUMBER OF SPACES THE VALUE OF A EXPRESION IS GOING TO
                ; BE PRINTED.  IT STAYS EFFECTIVE FOR THE REST OF THE PRINT
                ; COMMAND UNLESS CHANGED BY ANOTHER FORMAT.  IF NO FORMAT IS
                ; SPECIFIED, 6 POSITIONS WILL BE USED.
                ;

                ; A STRING IS QUOTED IN A PAIR OF SINGLE QUOTES OR A PAIR OF
                ; DOUBLE QUOTES.
                ;
                ; A BACK-ARROW MEANS GENERATE A (CR) WITHOUT (LF)
                ;
                ; A (CRLF) IS GENERATED AFTER THE ENTIRE LIST HAS BEEN
                ; PRINTED OR IF THE LIST IS A NULL LIST.  HOWEVER IF THE LIST
                ; ENDED WITH A COMMA, NO (CRLF) IS GENERATED.
                ;
016F CD7700     LIST:   CALL TSTNUM     ;TEST IF THERE IS A #
0172 CDC204             CALL ENDCHK     ;IF NO # WE GET A 0
0175 CD3805             CALL FNDLN      ;FIND THIS OR NEXT LINE
0178 DABA00     LS1:    JC   RSTART     ;C:PASSED TXTUNF
017B CDD205             CALL PRTLN      ;PRINT THE LINE
017E CD8406             CALL CHKIO      ;STOP IF HIT CONTROL-C
0181 CD4005             CALL FNDLP      ;FIND NEXT LINE
0184 C37801             JMP  LS1        ;AND LOOP BACK
                ;
0187 0E06       PRINT:  MVI  C,6        ;C = # OF SPACES
0189 CF                 RST  1          ;IF NULL LIST & ";"
018A 3B                 DB   3BH
018B 06                 DB   PR2-$-1
018C CD0E00             CALL CRLF       ;GIVE CR-LF AND
018F C35701             JMP  RUNSML     ;CONTINUE SAME LINE
0192 CF         PR2:    RST  1          ;IF NULL LIST (CR)
0193 0D                 DB   CR
0194 06                 DB   PR0-$-1
0195 CD0E00             CALL CRLF       ;ALSO GIVE CR-LF AND
0198 C34701     .       JMP  RUNNXL     ;GO TO NEXT LINE
019B CF         PR0:    RST  1          ;ELSE IS IT FORMAT?
019C 23                 DB   '#'
019D 05                 DB   PR1-$-1
019E DF                 RST  3          ;YES, EVALUATE EXPR.
019F 4D                 MOV  C,L        ;AND SAVE IT IN C
01A0 C3A901             JMP  PR3        ;LOOK FOR MORE TO PRINT
01A3 CD6C05     PR1:    CALL QTSTG      ;OR IS IT A STRING?
01A6 C3B601             JMP  PR8        ;IF NOT, MUST BE EXPR.
01A9 CF         PR3:    RST  1          ;IF ",", GO FIND NEXT
01AA 2C                 DB   ','
01AB 06                 DB   PR6-$-1
01AC CDB304             CALL FIN        ;IN THE LIST.
01AF C39B01             JMP  PR0        ;LIST CONTINUES
01B2 CD0E00     PR6:    CALL CRLF       ;LIST ENDS
01B5 F7                 RST  6
01B6 DF         PR8:    RST  3          ;EVALUATE THE EXPR
01B7 C5                 PUSH B
01B8 CD9205             CALL PRTNUM     ;PRINT THE VALUE
01BB C1                 POP  B
01BC C3A901             JMP  PR3        ;MORE TO PRINT?

                ;*****************************************************************
                ;
                ; *** GOSUB *** & RETURN ***
                ;
                ; 'GOSUB EXPR;' OR 'GOSUB EXPR (CR)' IS LIKE THE 'GOTO'
                ; COMMAND, EXCEPT THAT THE CURRENT TEXT POINTER, STACK POINTER
                ; ETC. ARE SAVE SO THAT EXECUTION CAN BE CONTINUED AFTER THE
                ; SUBROUTINE 'RETURN'.  IN ORDER THAT 'GOSUB' CAN BE NESTED
                ; (AND EVEN RECURSIVE), THE SAVE AREA MUST BE STACKED.
                ; THE STACK POINTER IS SAVED IN 'STKGOS' THE OLD 'STKGOS' IS
                ; SAVED IN THE STACK.  IF WE ARE IN THE MAIN ROUTINE, 'STKGOS'
                ; IS ZERO (THIS WAS DONE BY THE "MAIN" SECTION OF THE CODE),
                ; BUT WE STILL SAVE IT AS A FLAG FOR NO FURTHER 'RETURN'S.
                ;
                ; 'RETURN(CR)' UNDOS EVERYTHING THAT 'GOSUB' DID, AND THUS
                ; RETURN THE EXCUTION TO THE COMMAND AFTER THE MOST RECENT
                ; 'GOSUB'.  IF 'STKGOS' IS ZERO, IT INDICATES THAT WE
                ; NEVER HAD A 'GOSUB' AND IS THUS AN ERROR.
                ;
01BF CD1906     GOSUB:  CALL PUSHA      ;SAVE THE CURRENT "FOR"
01C2 DF                 RST  3          ;PARAMETERS
01C3 D5                 PUSH D          ;AND TEXT POINTER
01C4 CD3805             CALL FNDLN      ;FIND THE TARGET LINE
01C7 C2A000             JNZ  AHOW       ;NOT THERE.  SAY "HOW?"
01CA 2A0110             LHLD CURRNT     ;FOUND IT.  SAVE OLD
01CD E5                 PUSH H          ;'CURRNT' OLD 'STKGOS'
01CE 2A0310             LHLD STKGOS
01D1 E5                 PUSH H
01D2 210000             LXI  H,0        ;AND LOAD NEW ONES
01D5 220910             SHLD LOPVAR
01D8 39                 DAD  SP
01D9 220310             SHLD STKGOS
01DC C35001             JMP  RUNTSL     ;THEN RUN THAT LINE
                RETURN:
01DF CDC204             CALL ENDCHK     ;THERE MUST BE A CR
01E2 2A0310             LHLD STKGOS     ;OLD STACK POINTER
01E5 7C                 MOV  A,H        ;0 MEANS NOT EXIST
01E6 B5                 ORA  L
01E7 CAC604             JZ   QWHAT      ;SO, WE SAY: "WHAT?"
01EA F9                 SPHL            ;ELSE, RESTORE IT
01EB E1                 POP  H
01EC 220310             SHLD STKGOS     ;AND THE OLD 'STKGOS'
01EF E1                 POP  H
01F0 220110             SHLD CURRNT     ;AND THE OLD 'CURRNT'
01F3 D1                 POP  D          ;OLD TEXT POINTER
01F4 CDFD05             CALL POPA       ;OLD "FOR" PARAMETERS
01F7 F7                 RST  6          ;AND WE ARE BACK HOME
                ;
                ;*****************************************************************
```



THE FIRST WEST COAST COMPUTER FAIRE

A Conference & Exposition on Personal & Home Computers

San Francisco Bay Area—where it all started—finally gets its act together.

7,000-10,000 PEOPLE ▪ 100 CONFERENCE SESSIONS ▪ 200 COMMERCIAL & HOMEBREW EXHIBITS

2 BANQUETS ▪ SPECIAL INTEREST SOCIAL CENTERS

San Francisco Civic Auditorium, Northern California's Largest Convention Facility

YOU Can Be A Part Of It:

▪ *Some* of the things *you* can do are:

Exhibit a Homebrewed System
- Hardware or Software
- Prizes for Best "Homecooking" (just like a country fair)
- Nominal Grants-In-Aid Will Help With Exhibit Transportation Costs (grants will be refereed)

Present a Talk
- A Formal Paper
- An Informal Talk

Serve on a Panel
- As a Panel Member
- As the Coordinator/Moderator

Offer Suggestions
- Topics for Talks & Panels
- Speakers & Panel Participants
- Interesting Exhibits (homebrewed or commercial)
- Special Activities

▪ *Quick*, write or call for more details!
Jim Warren, Faire Chairperson
Box 1579
Palo Alto CA 94302
(415) 851-7664 v 323-3111

▪ *Some* of the **Conference Sections** being planned:
- Computer Graphics on Home Computers
- Computer-Driven, & Computer-Assisted Music Systems
- Speech Synthesis Using Home Computers
- Computers & Amateur Radio
- Microprogrammable Microprocessors for Hobbyists
- Program & Data Input via Optical Scanning
- Floppy Disc Systems for Personal Computers
- Computer Games: Alphanumeric & Graphic
- Computers & Systems for Very Small Businesses
- Personal Computers for the Physically Handicapped
- Personal Word-Processing Systems
- Software Design: Modularity & Portability
- Personal Computers for Education associated with a Univ. of California short-course
- Several Sections Concerning Standards
- Other Sections for Club Leaders, Editors, Organizers, etc.

▪ **Co-Sponsors** include amateur, professional, & educational groups:
- The Two Largest, Amateur Computer Organizations
 Homebrew Computer Club
 Southern California Computer Society
- Both Area Chapters of the Association for Computing Machinery
 San Francisco Peninsula Chapter & Golden Gate Chapter
- California Mathematics Council
- Stanford University's Electrical Engineering Department
- Community Computer Center
- People's Computer Company

april 15-17, 1977 · san francisco

©76-10-13 BY COMPUTER FAIRE

CIRCLE INQUIRY NO. 59

```
                        ; *** FOR *** & NEXT ***
                        ;
                        ; 'FOR' HAS TWO FORMS:
                        ; 'FOR VAR=EXP1 TO EXP2 STEP EXP3' AND 'FOR VAR=EXP1 TO EXP2'
                        ; THE SECOND FORM MEANS THE SAME THING AS THE FIRST FORM WITH
                        ; EXP3=1.  (I.E., WITH A STEP OF +1.)
                        ; TBI WILL FIND THE VARIABLE VAR. AND SET ITS VALUE TO THE
                        ; CURRENT VALUE OF EXP1.  IT ALSO EVALUATES EXP2 AND EXP3
                        ; AND SAVE ALL THESE TOGETHER WITH THE TEXT POINTER ETC.  IN
                        ; THE 'FOR' SAVE AREA, WHICH CONSISTS OF 'LOPVAR', 'LOPINC',
                        ; 'LOPLMT', 'LOPLN', AND 'LOPPT'.  IF THERE IS ALREADY SOME-
                        ; THING IN THE SAVE AREA (THIS IS INDICATED BY A NON-ZERO
                        ; 'LOPVAR'), THEN THE OLD SAVE AREA IS SAVED IN THE STACK
                        ; BEFORE THE NEW ONE OVERWRITES IT.
                        ; TBI WILL THEN DIG IN THE STACK AND FIND OUT IF THIS SAME
                        ; VARIABLE WAS USED IN ANOTHER CURRENTLY ACTIVE 'FOR' LOOP.
                        ; IF THAT IS THE CASE, THEN THE OLD 'FOR' LOOP IS DEACTIVATED.
                        ; (PURGED FROM THE STACK.)
                        ;
                        ; 'NEXT VAR' SERVES AS THE LOGICAL (NOT NECESSARILLY PHYSICAL)
                        ; END OF THE 'FOR' LOOP.  THE CONTROL VARIABLE VAR. IS CHECKED
                        ; WITH THE 'LOPVAR'.  IF THEY ARE NOT THE SAME, TBI DIGS IN
                        ; THE STACK TO FIND THE RIGHT ONE AND PURGES ALL THOSE THAT
                        ; DID NOT MATCH.  EITHER WAY, TBI THEN ADDS THE 'STEP' TO
                        ; THAT VARIABLE AND CHECK THE RESULT WITH THE LIMIT.  IF IT
                        ; IS WITHIN THE LIMIT, CONTROL LOOPS BACK TO THE COMMAND
                        ; FOLLOWING THE 'FOR'.  IF OUTSIDE THE LIMIT, THE SAVE ARER
                        ; IS PURGED AND EXECUTION CONTINUES.
                        ;
01F8 CD1906     FOR:    CALL PUSHA      ;SAVE THE OLD SAVE AREA
01FB CDA004             CALL SETVAL     ;SET THE CONTROL VAR.
01FE 2B                 DCX  H          ;HL IS ITS ADDRESS
01FF 220910             SHLD LOPVAR     ;SAVE THAT
0202 211307             LXI  H,TAB5-1   ;USE 'EXEC' TO LOOK
0205 C33B07             JMP  EXEC       ;FOR THE WORD 'TO'
0208 DF         FR1:    RST  3          ;EVALUATE THE LIMIT
0209 220D10             SHLD LOPLMT     ;SAVE THAT
020C 211907             LXI  H,TAB6-1   ;USE 'EXEC' TO LOOK
020F C33B07             JMP  EXEC       ;FOR THE WORD 'STEP'
0212 DF         FR2:    RST  3          ;FOUND IT, GET STEP
0213 C31902             JMP  FR4
0216 210100     FR3:    LXI  H,1H       ;NOT FOUND, SET TO 1
0219 220B10     FR4:    SHLD LOPINC     ;SAVE THAT TOO
021C 2A0110     FR5:    LHLD CURRNT     ;SAVE CURRENT LINE #
021F 220F10             SHLD LOPLN
0222 EB                 XCHG            ;AND TEXT POINTER
0223 221110             SHLD LOPPT
0226 010A00             LXI  B,0AH      ;DIG INTO STACK TO
0229 2A0910             LHLD LOPVAR     ;FIND 'LOPVAR'
022C EB                 XCHG

022D 60                 MOV  H,B
022E 68                 MOV  L,B        ;HL=0 NOW
022F 39                 DAD  SP         ;HERE IS THE STACK
0230 3E                 DB   3EH
0231 09         FR7:    DAD  B          ;EACH LEVEL IS 10 DEEP
0232 7E                 MOV  A,M        ;GET THAT OLD 'LOPVAR'
0233 23                 INX  H
0234 B6                 ORA  M
0235 CA5202             JZ   FR8        ;0 SAYS NO MORE IN IT
0238 7E                 MOV  A,M
0239 2B                 DCX  H
023A BA                 CMP  D          ;SAME AS THIS ONE?
023B C23102             JNZ  FR7
023E 7E                 MOV  A,M        ;THE OTHER HALF?
023F BB                 CMP  E
0240 C23102             JNZ  FR7
0243 EB                 XCHG            ;YES, FOUND ONE
0244 210000             LXI  H,0H
0247 39                 DAD  SP         ;TRY TO MOVE SP
0248 44                 MOV  B,H
0249 4D                 MOV  C,L
024A 210A00             LXI  H,0AH
024D 19                 DAD  D
024E CDEE05             CALL MVDOWN     ;AND PURGE 10 WORDS
0251 F9                 SPHL            ;IN THE STACK
0252 2A1110     FR8:    LHLD LOPPT      ;JOB DONE, RESTORE DE
0255 EB                 XCHG
0256 F7                 RST  6          ;AND CONTINUE
                        ;
0257 FF         NEXT:   RST  7          ;GET ADDRESS OF VAR.
0258 DAC604             JC   QWHAT      ;NO VARIABLE, "WHAT?"
025B 220510             SHLD VARNXT     ;YES, SAVE IT
025E D5         NX0:    PUSH D          ;SAVE TEXT POINTER
025F EB                 XCHG
0260 2A0910             LHLD LOPVAR     ;GET VAR. IN 'FOR'
0263 7C                 MOV  A,H
0264 B5                 ORA  L          ;0 SAYS NEVER HAD ONE
0265 CAC704             JZ   AWHAT      ;SO WE ASK: "WHAT?"
0268 E7                 RST  4          ;ELSE WE CHECK THEM
0269 CA7602             JZ   NX3        ;OK, THEY AGREE
026C D1                 POP  D          ;NO, LET'S SEE
026D CDFD05             CALL POPA       ;PURGE CURRENT LOOP
0270 2A0510             LHLD VARNXT     ;AND POP ONE LEVEL
0273 C35E02             JMP  NX0        ;GO CHECK AGAIN
0276 5E         NX3:    MOV  E,M        ;COME HERE WHEN AGREED
0277 23                 INX  H
0278 56                 MOV  D,M        ;DE=VALUE OF VAR.
0279 2A0B10             LHLD LOPINC
027C E5                 PUSH H
027D 7C                 MOV  A,H

027E AA                 XRA  D
027F 7A                 MOV  A,D
0280 19                 DAD  D          ;ADD ONE STEP
0281 FA8802             JM   NX4
0284 AC                 XRA  H
0285 FAAA02             JM   NX5
0288 EB         NX4:    XCHG
0289 2A0910             LHLD LOPVAR     ;PUT IT BACK
028C 73                 MOV  M,E
028D 23                 INX  H
028E 72                 MOV  M,D
028F 2A0D10             LHLD LOPLMT     ;HL=LIMIT
0292 F1                 POP  PSW        ;OLD HL
0293 B7                 ORA  A
0294 F29802             JP   NX1        ;STEP > 0
0297 EB                 XCHG
0298 CD9804     NX1:    CALL CKHLDE     ;COMPARE WITH LIMIT
029B D1                 POP  D          ;RESTORE TEXT POINTER
029C DAAC02             JC   NX2        ;OUTSIDE LIMIT
029F 2A0F10             LHLD LOPLN      ;WITHIN LIMIT, GO
02A2 221110             SHLD CURRNT     ;BACK TO THE SAVED
02A5 2A1110             LHLD LOPPT      ;'CURRNT' AND TEXT
02A8 EB                 XCHG            ;POINTER
02A9 F7                 RST  6
02AA E1         NX5:    POP  H
02AB D1                 POP  D
02AC CDFD05     NX2:    CALL POPA       ;PURGE THIS LOOP
02AF F7                 RST  6
```

```
                        ;*************************************************************
                        ;
                        ; *** REM *** IF *** INPUT *** & LET (& DEFLT) ***
                        ;
                        ; 'REM' CAN BE FOLLOWED BY ANYTHING AND IS IGNORED BY TBI.
                        ; TBI TREATS IT LIKE AN 'IF' WITH A FALSE CONDITION.
                        ;
                        ; 'IF' IS FOLLOWED BY AN EXPR. AS A CONDITION AND ONE OR MORE
                        ; COMMANDS (INCLUDING  OTHER 'IF'S) SEPERATED BY SEMI-COLONS.
                        ; NOTE THAT THE WORD 'THEN' IS NOT USED.  TBI EVALUATES THE
                        ; EXPR.  IF IT IS NON-ZERO, EXECUTION CONTINUES.  IF THE
                        ; EXPR. IS ZERO, THE COMMANDS THAT FOLLOWS ARE IGNORED AND
                        ; EXECUTION CONTINUES AT THE NEXT LINE.
                        ;
                        ; 'INPUT' COMMAND IS LIKE THE 'PRINT' COMMAND, AND IS FOLLOWED
                        ; BY A LIST OF ITEMS.  IF THE ITEM IS A STRING IN SINGLE OR
                        ; DOUBLE QUOTES, OR IS A BACK-ARROW, IT HAS THE SAME EFFECT AS
                        ; IN 'PRINT'.  IF AN ITEM IS A VARIABLE, THIS VARIABLE NAME IS
                        ; PRINTED OUT FOLLOWED BY A COLON.  THEN TBI WAITS FOR AN
                        ; EXPR. TO BE TYPED IN.  THE VARIABLE IS THEN SET TO THE
                        ; VALUE OF THIS EXPR.  IF THE VARIABLE IS PROCEDED BY A STRING

                        ; (AGAIN IN SINGLE OR DOUBLE QUOTES), THE STRING WILL BE
                        ; PRINTED FOLLOWED BY A COLON.  TBI THEN WAITS FOR INPUT EXPR.
                        ; AND SET THE VARIABLE TO THE VALUE OF THE EXPR.
                        ;
                        ; IF THE INPUT EXPR. IS INVALID, TBI WILL PRINT "WHAT?",
                        ; "HOW?" OR "SORRY" AND REPRINT THE PROMPT AND REDO THE INPUT.
                        ; THE EXECUTION WILL NOT TERMINATE UNLESS YOU TYPE CONTROL-C.
                        ; THIS IS HANDLED IN 'INPERR'.
                        ;
                        ; 'LET' IS FOLLOWED BY A LIST OF ITEMS SEPERATED BY COMMAS.
                        ; EACH ITEM CONSISTS OF A VARIABLE, AN EQUAL SIGN, AND AN EXPR.
                        ; TBI EVALUATES THE EXPR. AND SET THE VARIBLE TO THAT VALUE.
                        ; TBI WILL ALSO HANDLE 'LET' COMMAND WITHOUT THE WORD 'LET'.
                        ; THIS IS DONE BY 'DEFLT'.
                        ;
02B0 210000     REM:    LXI  H,0H       ;*** REM ***
02B3 3E                 DB   3EH
                        ;
02B4 DF         IFF:    RST  3          ;*** IF ***
02B5 7C                 MOV  A,H        ;IS THE EXPR. =0?
02B6 B5                 ORA  L
02B7 C25701             JNZ  RUNSML     ;NO, CONTINUE
02BA CD5605             CALL FNDSKP     ;YES, SKIP REST OF LINE
02BD D25001             JNC  RUNTSL
02C0 C3BA00             JMP  RSTART
                        ;
                        INPERR:
02C3 2A0710             LHLD STKINP     ;*** INPERR ***
02C6 F9                 SPHL            ;RESTORE OLD SP
02C7 E1                 POP  H          ;AND OLD 'CURRNT'
02C8 220110             SHLD CURRNT
02CB D1                 POP  D          ;AND OLD TEXT POINTER
02CC D1                 POP  D          ;REDO INPUT
                        ;
                        INPUT:                  ;*** INPUT ***
02CD D5         IP1:    PUSH D          ;SAVE IN CASE OF ERROR
02CE CD6C05             CALL QTSTG      ;IS NEXT ITEM A STRING?
02D1 C3D802             JMP  IP2        ;NO
02D4 FF                 RST  7          ;YES.  BUT FOLLOWED BY A
02D5 DA1503             JC   IP4        ;VARIABLE?  NO.
02D8 C3EB02             JMP  IP3        ;YES.  INPUT VARIABLE
02DB D5         IP2:    PUSH D          ;SAVE FOR 'PRTSTG'
02DC FF                 RST  7          ;MUST BE VARIABLE NOW
02DD DAC604             JC   QWHAT      ;"WHAT?" IT IS NOT?
02E0 1A                 LDAX D          ;GET READY FOR 'PRTSTG'
02E1 4F                 MOV  C,A
02E2 97                 SUB  A
02E3 12                 STAX D
02E4 D1                 POP  D
02E5 CD6005             CALL PRTSTG     ;PRINT STRING AS PROMPT

02E8 79                 MOV  A,C        ;RESTORE TEXT
02E9 1B                 DCX  D
02EA 12                 STAX D
02EB D5         IP3:    PUSH D          ;SAVE TEXT POINTER
02EC EB                 XCHG
02ED 2A0110             LHLD CURRNT     ;ALSO SAVE 'CURRNT'
02F0 E5                 PUSH H
02F1 21CD02             LXI  H,IP1      ;A NEGATIVE NUMBER
02F4 220110             SHLD CURRNT     ;AS A FLAG
02F7 210000             LXI  H,0H       ;SAVE SP TOO
02FA 39                 DAD  SP
02FB 220710             SHLD STKINP
02FE D5                 PUSH D          ;OLD HL
02FF 3E3A               MVI  A,3AH      ;PRINT THIS TOO
0301 CDFA04             CALL GETLN      ;AND GET A LINE
0304 119D13             LXI  D,BUFFER   ;POINTS TO BUFFER
0307 DF                 RST  3          ;EVALUATE INPUT
0308 00                 NOP             ;CAN BE 'CALL ENDCHK'
0309 00                 NOP
030A 00                 NOP
030B D1                 POP  D          ;OK, GET OLD HL
030C EB                 XCHG
030D 73                 MOV  M,E        ;SAVE VALUE IN VAR.
030E 23                 INX  H
030F 72                 MOV  M,D
0310 E1                 POP  H          ;GET OLD 'CURRNT'
0311 220110             SHLD CURRNT
0314 D1                 POP  D          ;AND OLD TEXT POINTER
0315 F1         IP4:    POP  PSW        ;PURGE JUNK IN STACK
0316 CF                 RST  1          ;IS NEXT CH. ',' ?
0317 2C                 DB   ','
0318 03                 DB   IP5-$-1
0319 C3CD02             JMP  IP1        ;YES, MORE ITEMS.
031C F7         IP5:    RST  6
                        ;
031D 1A         DEFLT:  LDAX D          ;*** DEFLT ***
031E FE0D               CPI  CR         ;EMPTY LINE IS OK
0320 CA2C02             JZ   LT1        ;ELSE IT IS 'LET'
                        ;
0323 CDA004     LET:    CALL SETVAL     ;*** LET ***
0326 CF                 RST  1          ;SET VALUE TO VAR.
0327 2C                 DB   ','
0328 02                 DB   LT1-$-1
0329 C32303             JMP  LET        ;ITEM BY ITEM
032C F7         LT1:    RST  6          ;UNTIL FINISH
                        ;
                        ;*************************************************************
                        ;
                        ; *** EXPR ***
                        ;

                        ; 'EXPR' EVALUATES ARITHMETICAL OR LOGICAL EXPRESSIONS.
                        ; <EXPR>::=<EXPR2>
                        ;         <EXPR2><REL. OP.><EXPR2>
                        ; WHERE <REL. OP.> IS ONE OF THE OPERATORS IN TAB8 AND THE
                        ; RESULT OF THESE OPERATIONS IS 1 IF TRUE AND 0 IF FALSE.
                        ; <EXPR2>::=(+ OR -)<EXPR3>(<+ OR -><EXPR3>)(....)
                        ; WHERE () ARE OPTIONAL AND (....) ARE OPTIONAL REPEATS.
                        ; <EXPR3>::=<EXPR4>(<* OR /><EXPR4>)(....)
                        ; <EXPR4>::=<VARIABLE>
```

```
                ;           <FUNCTION>
                ;           (<EXPR>)
                ; <EXPR> IS RECURSIVE SO THAT VARIABLE '@' CAN HAVE AN <EXPR>
                ; AS INDEX, FUNCTIONS CAN HAVE AN <EXPR> AS ARGUMENTS, AND
                ; <EXPR4> CAN BE AN <EXPR> IN PARANTHESE.
                ;
                ;                   EXPR    CALL EXPR2      THIS IS AT LOC. 18
                ;                           PUSH HL         SAVE <EXPR2> VALUE
022D 212107     EXPR1: LXI  H,TAB8-1 ;LOOKUP REL. OP.
0230 C33B07            JMP  EXEC     ;GO DO IT
0233 CD5C03     XP11:  CALL XP18     ;REL. OP. ">="
0236 D8                RC            ;NO, RETURN HL=0
0237 6F                MOV  L,A      ;YES, RETURN HL=1
0238 C9                RET
0239 CD5C03     XP12:  CALL XP18     ;REL. OP. "#"
023C C8                RZ            ;FALSE, RETURN HL=0
023D 6F                MOV  L,A      ;TRUE, RETURN HL=1
023E C9                RET
023F CD5C03     XP13:  CALL XP18     ;REL. OP. ">"
0242 C8                RZ            ;FALSE
0243 D8                RC            ;ALSO FALSE, HL=0
0244 6F                MOV  L,A      ;TRUE, HL=1
0245 C9                RET
0246 CD5C03     XP14:  CALL XP18     ;REL. OP. "<="
0249 6F                MOV  L,A      ;SET HL=1
024A C8                RZ            ;REL. TRUE, RETURN
024B D8                RC
024C 6C                MOV  L,H      ;ELSE SET HL=0
024D C9                RET
024E CD5C03     XP15:  CALL XP18     ;REL. OP. "="
0251 C0                RNZ           ;FALSE, RETRUN HL=0
0252 6F                MOV  L,A      ;ELSE SET HL=1
0253 C9                RET
0254 CD5C03     XP16:  CALL XP18     ;REL. OP. "<"
0257 D0                RNC           ;FALSE, RETURN HL=0
0258 6F                MOV  L,A      ;ELSE SET HL=1
0259 C9                RET
025A E1         XP17:  POP  H        ;NOT REL. OP.
025B C9                RET           ;RETURN HL=<EXPR2>
025C 79         XP18:  MOV  A,C      ;SUBROUTINE FOR ALL
025D E1                POP  H        ;REL. OP.'S
025E C1                POP  B
025F E5                PUSH H        ;REVERSE TOP OF STACK
0260 C5                PUSH B
0261 4F                MOV  C,A
0262 CD7102            CALL EXPR2    ;GET 2ND <EXPR2>
0265 EB                XCHG          ;VALUE IN DE NOW
0266 E3                XTHL          ;1ST <EXPR2> IN HL
0267 CD9804            CALL CKHLDE   ;COMPARE 1ST WITH 2ND
026A D1                POP  D        ;RESTORE TEXT POINTER
026B 210000            LXI  H,0H     ;SET HL=0, A=1
026E 3E01              MVI  A,1
0270 C9                RET
                ;
0271 CF         EXPR2: RST  1        ;NEGATIVE SIGN?
0272 2D                DB   '-'
0273 0E                DB   XP21-$-1
0274 210000            LXI  H,0H     ;YES, FAKE '0-'
0277 C39B02            JMP  XP26     ;TREAT LIKE SUBTRACT
027A CF         XP21:  RST  1        ;POSITIVE SIGN?  IGNORE
027B 2B                DB   '+'
027C 00                DB   XP22-$-1
027D CDA502     XP22:  CALL EXPR3    ;1ST <EXPR3>
0280 CF         XP23:  RST  1        ;ADD?
0281 1B                DB   '+'
0282 15                DB   XP25-$-1
0283 E5                PUSH H        ;YES, SAVE VALUE
0284 CDA502            CALL EXPR3    ;GET 2ND <EXPR3>
0287 EB         XP24:  XCHG          ;2ND IN DE
0288 E3                XTHL          ;1ST IN HL
0289 7C                MOV  A,H      ;COMPARE SIGN
028A AA                XRA  D
028B 7A                MOV  A,D
028C 19                DAD  D
028D D1                POP  D        ;RESTORE TEXT POINTER
028E FA9002            JM   XP23     ;1ST 2ND SIGN DIFFER
0291 AC                XRA  H        ;1ST 2ND SIGN EQUAL
0292 F28002            JP   XP23     ;SO IS RESULT
0295 C39F00            JMP  OHOW     ;ELSE WE HAVE OVERFLOW
0298 CF         XP25:  RST  1        ;SUBTRACT?
0299 2D                DB   '-'
029A 86                DB   XP42-$-1
029B E5         XP26:  PUSH H        ;YES, SAVE 1ST <EXPR2>
029C CDA502            CALL EXPR3    ;GET 2ND \PR3>
029F CD8004            CALL CHGSGN   ;NEGATE
02A2 C38703            JMP  XP24     ;AND ADD THEM
                ;
02A5 CD0504     EXPR3: CALL EXPR4    ;GET 1ST <EXPR4>
02A8 CF         XP31:  RST  1        ;MULTIPLY?
02A9 2A                DB   '*'
02AA 2D                DB   XP34-$-1
02AB E5                PUSH H        ;YES, SAVE 1ST
02AC CD0504            CALL EXPR4    ;AND GET 2ND <EXPR4>
02AF 0600              MVI  B,0H     ;CLEAR B FOR SIGN
02B1 CD8704            CALL CHKSGN   ;CHECK SIGN
02B4 E3                XTHL          ;1ST IN HL
02B5 CD8304            CALL CHKSGN   ;CHECK SIGN OF 1ST
02B8 EB                XCHG
02B9 E3                XTHL
02BA 7C                MOV  A,H      ;IS HL > 255 ?
02BB B7                ORA  A
02BC CAC502            JZ   XP32     ;NO
02BF 7A                MOV  A,D      ;YES, HOW ABOUT DE
02C0 B2                ORA  D
02C1 EB                XCHG          ;PUT SMALLER IN HL
02C2 C2A000            JNZ  AHOW     ;ALSO >, WILL OVERFLOW
02C5 7D         XP32:  MOV  A,L      ;THIS IS DUMB
02C6 210000            LXI  H,0H     ;CLEAR RESULT
02C9 B7                ORA  A        ;ADD AND COUNT
02CA CAF702            JZ   XP35
02CD 19         XP33:  DAD  D
02CE DAA000            JC   AHOW     ;OVERFLOW
02D1 3D                DCR  A
02D2 C2CD02            JNZ  XP33
02D5 C3F703            JMP  XP35     ;FINISHED
02D8 CF         XP34:  RST  1        ;DIVIDE?
02D9 2F                DB   '/'
02DA 46                DB   XP42-$-1
02DB E5                PUSH H        ;YES, SAVE 1ST <EXPR4>
02DC CD0504            CALL EXPR4    ;AND GET 2ND ONE
02DF 0600              MVI  B,0H     ;CLEAR B FOR SIGN
02E1 CD8304            CALL CHKSGN   ;CHECK SIGN OF 2ND
02E4 E3                XTHL          ;GET 1ST IN HL
02E5 CD8304            CALL CHKSGN   ;CHECK SIGN OF 1ST
02E8 EB                XCHG
02E9 E3                XTHL
02EA EB                XCHG
02EB 7A                MOV  A,D      ;DIVIDE BY 0?
02EC B2                ORA  E
02ED CAA000            JZ   AHOW     ;SAY "HOW?"
02F0 C5                PUSH B        ;ELSE SAVE SIGN
02F1 CD6604            CALL DIVIDE   ;USE SUBROUTINE
02F4 60                MOV  H,B      ;RESULT IN HL NOW
02F5 69                MOV  L,C
02F6 C1                POP  B        ;GET SIGN BACK
02F7 D1         XP35:  POP  D        ;AND TEXT POINTER
02F8 7C                MOV  A,H      ;HL MUST BE +
02F9 B7                ORA  A
02FA FA9F00            JM   OHOW     ;ELSE IT IS OVERFLOW
02FD 78                MOV  A,B
02FE B7                ORA  A
02FF FC8604            CM   CHGSGN   ;CHANGE SIGN IF NEEDED
0302 C3A802            JMP  XP31     ;LOOK FOR MORE TERMS

0305 210107     EXPR4: LXI  H,TAB4-1 ;FIND FUNCTION IN TAB4
0308 C33B07            JMP  EXEC     ;AND GO DO IT
030B FF         XP40:  RST  7        ;NO, NOT A FUNCTION
030C DA1404            JC   XP41     ;NOR A VARIABLE
030F 7E                MOV  A,M      ;VARIABLE
0310 23                INX  H
0311 66                MOV  H,M      ;VALUE IN HL
0312 6F                MOV  L,A
0313 C9                RET
0314 CD7700     XP41:  CALL TSTNUM   ;OR IS IT A NUMBER
0317 78                MOV  A,B      ;# OF DIGIT
0318 B7                ORA  A
0319 C0                RNZ           ;OK
031A CF         PARN:  RST  1        ;NO DIGIT, MUST BE
031B 28                DB   '('
031C 05                DB   XP43-$-1
031D DF                RST  3        ;"(EXPR)"
031E CF                RST  1
031F 29                DB   ')'
0320 01                DB   XP43-$-1
0321 C9         XP42:  RET
0322 C30604     XP43:  JMP  QWHAT     ;ELSE SAY: "WHAT?"
                ;
0325 CD1A04     RND:   CALL PARN     ;*** RND(EXPR) ***
0328 7C                MOV  A,H      ;EXPR MUST BE +
0329 B7                ORA  A
032A FA9F00            JM   OHOW
032D B5                ORA  L        ;AND NON-ZERO
032E CA9F00            JZ   OHOW
0331 D5                PUSH D        ;SAVE BOTH
0332 E5                PUSH H
0333 2A1310            LHLD RANPNT   ;GET MEMORY AS RANDOM
0336 116907            LXI  D,LSTROM ;NUMBER
0339 E7                RST  4
033A DA4004            JC   RA1      ;WRAP AROUND IF LAST
033D 210000            LXI  H,START
0340 5E         RA1:   MOV  E,M
0341 23                INX  H
0342 56                MOV  D,M
0343 221310            SHLD RANPNT
0346 E1                POP  H
0347 EB                XCHG
0348 C5                PUSH B
0349 CD6604            CALL DIVIDE   ;RND(N)=MOD(M,N)+1
034C C1                POP  B
034D D1                POP  D
034E 23                INX  H
034F C9                RET
                ;
0350 CD1A04     ABS:   CALL PARN     ;*** ABS(EXPR) ***
0353 1B                DCX  D
0354 CD8304            CALL CHKSGN   ;CHECK SIGN
0357 13                INX  D
0358 C9                RET
0359 2A1510     SIZE:  LHLD TXTUNF   ;*** SIZE ***
035C D5                PUSH D        ;GET THE NUMBER OF FREE
035D EB                XCHG          ;BYTES BETWEEN 'TXTUNF'
035E 216613            LXI  H,VARBGN ;AND 'VARBGN'
0361 CD7C04            CALL SUBDE
0364 D1                POP  D
0365 C9                RET
                ;
                ;*********************************************************
                ;
                ; *** DIVIDE *** SUBDE *** CHKSGN *** CHGSGN *** & CKHLDE ***
                ;
                ; 'DIVIDE' DIVIDES HL BY DE, RESULT IN BC, REMAINDER IN HL
                ;
                ; 'SUBDE' SUBTRACTS DE FROM HL
                ;
                ; 'CHKSGN' CHECKS SIGN OF HL.  IF +, NO CHANGE.  IF -, CHANGE
                ; SIGN AND FLIP SIGN OF B.
                ;
                ; 'CHGSGN' CHNGES SIGN OF HL AND B UNCONDITIONALLY.
                ;
                ; 'CKHLDE' CHECKS SIGN OF HL AND DE.  IF DIFFERENT, HL AND DE
                ; ARE INTERCHANGED.  IF SAME SIGN, NOT INTERCHANGED.  EITHER
                ; CASE, HL DE ARE THEN COMPARED TO SET THE FLAGS.
                ;
                DIVIDE:
0366 E5                 PUSH H        ;*** DIVIDE ***
0367 6C                 MOV  L,H      ;DIVIDE H BY DE
0368 2600               MVI  H,0
036A CD7104             CALL DV1
036D 41                 MOV  B,C      ;SAVE RESULT IN B
036E 7D                 MOV  A,L      ;(REMAINDER+L)/DE
036F E1                 POP  H
0370 67                 MOV  H,A
0371 0EFF       DV1:    MVI  C,0FFH   ;RESULT IN C
0373 0C         DV2:    INR  C        ;DUMB ROUTINE
0374 CD7C04             CALL SUBDE    ;DIVIDE BY SUBTRACT
0377 D27304             JNC  DV2      ;AND COUNT
037A 19                 DAD  D
037B C9                 RET
                ;
037C 7D         SUBDE:  MOV  A,L      ;*** SUBDE ***
037D 93                 SUB  E        ;SUBTRACT DE FROM
037E 6F                 MOV  L,A      ;HL
037F 7C                 MOV  A,H
0380 9A                 SBB  D
0381 67                 MOV  H,A
0382 C9                 RET
                ;
                CHKSGN:
0383 7C                 MOV  A,H      ;*** CHKSGN ***
0384 B7                 ORA  A        ;CHECK SIGN OF HL
0385 F0                 RP            ;IF -, CHANGE SIGN
                ;
                CHGSGN:
0386 7C                 MOV  A,H      ;*** CHGSGN ***
0387 F5                 PUSH PSW
0388 2F                 CMA           ;CHANGE SIGN OF HL
0389 67                 MOV  H,A
038A 7D                 MOV  A,L
038B 2F                 CMA
038C 6F                 MOV  L,A
038D 23                 INX  H
038E F1                 POP  PSW
038F AC                 XRA  H
0390 F29F00             JP   OHOW
0393 78                 MOV  A,B      ;AND ALSO FLIP B
0394 EE80               XRI  80H
0396 47                 MOV  B,A
0397 C9                 RET
```

```
                CKHLDE:
0498 7C                 MOV  A,H
0499 AA                 XRA  D          ;SAME SIGN?
049A F29E04             JP   CK1        ;YES, COMPARE
049D EB                 XCHG            ;NO, XCH AND COMP
049E E7         CK1:    RST  4
049F C9                 RET
                ;
                ;*****************************************************
                ;
                ; *** SETVAL *** FIN *** ENDCHK *** & ERROR (& FRIENDS) ***
                ;
                ; "SETVAL" EXPECTS A VARIABLE, FOLLOWED BY AN EQUAL SIGN AND
                ; THEN AN EXPR.  IT EVALUATES THE EXPR. AND SET THE VARIABLE
                ; TO THAT VALUE.
                ;
                ; "FIN" CHECKS THE END OF A COMMAND.  IF IT ENDED WITH ";",
                ; EXECUTION CONTINUES.  IF IT ENDED WITH A CR, IT FINDS THE
                ; NEXT LINE AND CONTINUE FROM THERE.
                ;
                ; "ENDCHK" CHECKS IF A COMMAND IS ENDED WITH CR.  THIS IS
                ; REQUIRED IN CERTAIN COMMANDS. (GOTO, RETURN, AND STOP ETC.)
                ;
                ; "ERROR" PRINTS THE STRING POINTED BY DE (AND ENDS WITH CR),
                ; IT THEN PRINTS THE LINE POINTED BY 'CURRNT' WITH A "?"
                ; INSERTED AT WHERE THE OLD TEXT POINTER (SHOULD BE ON TOP
                ; OF THE STACK) POINTS TO.  EXECUTION OF TB IS STOPPED
                ; AND TBI IS RESTARTED.  HOWEVER, IF 'CURRNT' -> ZERO
                ; (INDICATING A DIRECT COMMAND), THE DIRECT COMMAND IS NOT
                ; PRINTED.  AND IF 'CURRNT' -> NEGATIVE # (INDICATING 'INPUT'
                ; COMMAND), THE INPUT LINE IS NOT PRINTED AND EXECUTION IS
                ; NOT TERMINATED BUT CONTINUED AT 'INPERR'.
                ;
                ; RELATED TO 'ERROR' ARE THE FOLLOWING:
                ; 'QWHAT' SAVES TEXT POINTER IN STACK AND GET MESSAGE "WHAT?"
                ; 'AWHAT' JUST GET MESSAGE "WHAT?" AND JUMP TO 'ERROR'.
                ; 'QSORRY' AND 'ASORRY' DO SAME KIND OF THING.
                ; 'QHOW' AND 'AHOW' IN THE ZERO PAGE SECTION ALSO DO THIS
                ;
                SETVAL:
04A0 FF                 RST  7          ;*** SETVAL ***
04A1 DAC604             JC   QWHAT      ;"WHAT?" NO VARIABLE
04A4 E5                 PUSH H          ;SAVE ADDRESS OF VAR.
04A5 CF                 RST  1          ;PASS "=" SIGN
04A6 3D                 DB   '='
04A7 08                 DB   SV1-$-1
04A8 DF                 RST  3          ;EVALUATE EXPR.
04A9 44                 MOV  B,H        ;VALUE IN BC NOW
04AA 4D                 MOV  C,L
04AB E1                 POP  H          ;GET ADDRESS
04AC 71                 MOV  M,C        ;SAVE VALUE
04AD 23                 INX  H
04AE 70                 MOV  M,B
04AF C9                 RET
04B0 C3C604     SV1:    JMP  QWHAT      ;NO "=" SIGN
                ;
04B3 CF         FIN:    RST  1          ;*** FIN ***
04B4 3B                 DB   3BH
04B5 04                 DB   FI1-$-1
04B6 F1                 POP  PSW        ;";", PURGE RET ADDR.
04B7 C25701             JMP  RUNSML     ;CONTINUE SAME LINE
04BA CF         FI1:    RST  1          ;NOT ";", IS IT CR?
04BB 0D                 DB   CR
04BC 04                 DB   FI2-$-1
04BD F1                 POP  PSW        ;YES, PURGE RET ADDR.
04BE C34701             JMP  RUNNXL     ;RUN NEXT LINE
04C1 C9         FI2:    RET             ;ELSE RETURN TO CALLER
                ;
                ENDCHK:
04C2 EF                 RST  5          ;*** ENDCHK ***
04C3 FE0D               CPI  CR         ;END WITH CR?
04C5 C8                 RZ              ;OK, ELSE SAY: "WHAT?"
                ;
04C6 D5         QWHAT:  PUSH D          ;*** QWHAT ***
04C7 11AE00     AWHAT:  LXI  D,AWHAT    ;*** AWHAT ***
04CA 97         ERROR:  SUB  A          ;*** ERROR ***
04CB CD6005             CALL PRTSTG     ;PRINT 'WHAT?', 'HOW?'
04CE D1                 POP  D          ;OR 'SORRY'
04CF 1A                 LDAX D          ;SAVE THE CHARACTER
04D0 F5                 PUSH PSW        ;AT WHERE OLD DE ->
04D1 97                 SUB  A          ;AND PUT A 0 THERE
04D2 12                 STAX D
04D3 2A0110             LHLD CURRNT     ;GET CURRENT LINE #
04D6 E5                 PUSH H
04D7 7E                 MOV  A,M        ;CHECK THE VALUE
04D8 23                 INX  H
04D9 B6                 ORA  M
04DA D1                 POP  D
04DB CABA00             JZ   RSTART     ;IF ZERO, JUST RERSTART
04DE 7E                 MOV  A,M        ;IF NEGATIVE,
04DF B7                 ORA  A
04E0 FAC202             JM   INPERR     ;REDO INPUT
04E3 CDD305             CALL PRTLN      ;ELSE PRINT THE LINE
04E6 1B                 DCX  D          ;UPTO WHERE THE 0 IS
04E7 F1                 POP  PSW        ;RESTORE THE CHARACTER
04E8 12                 STAX D
04E9 3E3F               MVI  A,3FH      ;PRINT A "?"
04EB D7                 RST  2
04EC 97                 SUB  A          ;AND THE REST OF THE
04ED CD6005             CALL PRTSTG
04F0 C3B800             JMP  RSTART
                QSORRY:
04F3 D5                 PUSH D          ;*** QSORRY ***
04F4 11B400     ASORRY: LXI  D,SORRY    ;*** ASORRY ***
04F7 C3CA04             JMP  ERROR
                ;
                ;*****************************************************
                ;
                ; *** GETLN *** FNDLN (& FRIENDS) ***
                ;
                ; 'GETLN' READS A INPUT LINE INTO 'BUFFER'.  IT FIRST PROMPT
                ; THE CHARACTER IN A (GIVEN BY THE CALLER), THEN IT FILLS THE
                ; THE BUFFER AND ECHOS.  IT IGNORES LF'S AND NULLS, BUT STILL
                ; ECHOS THEM BACK.  RUB-OUT IS USED TO CAUSE IT TO DELETE
                ; THE LAST CHARATER (IF THERE IS ONE), AND ALT-MOD IS USED TO
                ; CAUSE IT TO DELETE THE WHOLE LINE AND START IT ALL OVER.
                ; CR SIGNALS THE END OF A LINE, AND CAUSE 'GETLN' TO RETURN.
                ;
                ; 'FNDLN' FINDS A LINE WITH A GIVEN LINE # (IN HL) IN THE
                ; TEXT SAVE AREA.  DE IS USED AS THE TEXT POINTER.  IF THE
                ; LINE IS FOUND, DE WILL POINT TO THE BEGINNING OF THAT LINE
                ; (I.E., THE LOW BYTE OF THE LINE #), AND FLAGS ARE NC & Z.
                ; IF THAT LINE IS NOT THERE AND A LINE WITH A HIGHER LINE #
                ; IS FOUND, DE POINTS TO THERE AND FLAGS ARE NC & NZ.  IF
                ; WE REACHED THE END OF TEXT SAVE ARE AND CANNOT FIND THE
                ; LINE, FLAGS ARE C & NZ.
                ; 'FNDLN' WILL INITIALIZE DE TO THE BEGINNING OF THE TEXT SAVE
                ; AREA TO START THE SEARCH.  SOME OTHER ENTRIES OF THIS
                ; ROUTINE WILL NOT INITIALIZE DE AND DO THE SEARCH.
                ; 'FNDLNP' WILL START WITH DE AND SEARCH FOR THE LINE #.
                ; 'FNDNXT' WILL BUMP DE BY 2, FIND A CR AND THEN START SEARCH.
                ; 'FNDSKP' USE DE TO FIND A CR, AND THEN STRART SEARCH.
                ;
04FA D7         GETLN:  RST  2          ;*** GETLN ***
04FB 119D12             LXI  D,BUFFER   ;PROMPT AND INIT.
04FE CD8406     GL1:    CALL CHKIO      ;CHECK KEYBOARD
0501 CAFE04             JZ   GL1        ;NO INPUT, WAIT
0504 FE7F               CPI  7FH        ;DELETE LAST CHARACTER?
0506 CA2305             JZ   GL2        ;YES
0509 D7                 RST  2          ;INPUT, ECHO BACK
050A FE0A               CPI  0AH        ;IGNORE LF
050C CAFE04             JZ   GL1
050F B7                 ORA  A          ;IGNORE NULL
0510 CAFE04             JZ   GL1
0513 FE7D               CPI  7DH        ;DELETE THE WHOLE LINE?
0515 CA3005             JZ   GL4        ;YES
0518 12                 STAX D          ;ELSE, SAVE INPUT
0519 13                 INX  D          ;AND BUMP POINTER
051A FE0D               CPI  0DH        ;WAS IT CR?
051C C8                 RZ              ;YES, END OF LINE
051D 7B                 MOV  A,E        ;ELSE, MORE FREE ROOM?
051E FEDD               CPI  BUFEND AND 0FFH
0520 C2FE04             JNZ  GL1        ;YES, GET NEXT INPUT
0523 7B         GL3:    MOV  A,E        ;DELETE LAST CHARACTER
0524 FE9D               CPI  BUFFER AND 0FFH
0526 CA3005             JZ   GL4        ;NO, REDO WHOLE LINE
0529 1B                 DCX  D          ;YES, BACKUP POINTER
052A 3E5C               MVI  A,5CH      ;AND ECHO A BACK-SLASH
052C D7                 RST  2
052D C3FE04             JMP  GL1        ;GO GET NEXT INPUT
0530 CD0E00     GL4:    CALL CRLF       ;REDO ENTIRE LINE
0533 3E5E               MVI  A,05EH     ;CR, LF AND UP-ARROW
0535 C3FA04             JMP  GETLN
                ;
0538 7C         FNDLN:  MOV  A,H        ;*** FNDLN ***
0539 B7                 ORA  A          ;CHECK SIGN OF HL
053A FA9F00             JM   QHOW       ;IT CANNOT BE -
053D 111710             LXI  D,TXTBGN   ;INIT. TEXT POINTER
                ;
                FNDLP:                  ;*** FNDLNP ***
0540 E5         FL1:    PUSH H          ;SAVE LINE #
                ;
0541 2A1510             LHLD TXTUNF     ;CHECK IF WE PASSED END
0544 2B                 DCX  H
0545 E7                 RST  4
0546 E1                 POP  H          ;GET LINE # BACK
0547 D8                 RC              ;C,NZ PASSED END
0548 1A                 LDAX D          ;WE DID NOT, GET BYTE 1
0549 95                 SUB  L          ;IS THIS THE LINE?
054A 47                 MOV  B,A        ;COMPARE LOW ORDER
054B 13                 INX  D
054C 1A                 LDAX D          ;GET BYTE 2
054D 9C                 SBB  H          ;COMPARE HIGH ORDER
054E DA5505             JC   FL2        ;NO, NOT THERE YET
0551 1B                 DCX  D          ;ELSE WE EITHER FOUND
0552 B0                 ORA  B          ;IT, OR IT IS NOT THERE
0553 C9                 RET             ;NC,Z:FOUND; NC,NZ:NO
                ;
                FNDNXT:                 ;*** FNDNXT ***
0554 13                 INX  D          ;FIND NEXT LINE
0555 13         FL2:    INX  D          ;JUST PASSED BYTE 1 & 2
                ;
                FNDSKP:
0556 1A                 LDAX D          ;*** FNDSKP ***
0557 FE0D               CPI  CR         ;TRY TO FIND CR
0559 C25505             JNZ  FL2        ;KEEP LOOKING
055C 13                 INX  D          ;FOUND CR, SKIP OVER
055D C34005             JMP  FL1        ;CHECK IF END OF TEXT
                ;
                ;*****************************************************
                ;
                ; *** PRTSTG *** OTSTG *** PRTNUM *** & PRTLN ***
                ;
                ; 'PRTSTG' PRINTS A STRING POINTED BY DE.  IT STOPS PRINTING
                ; AND RETURNS TO CALLER WHEN EITHER A CR IS PRINTED OR WHEN
                ; THE NEXT BYTE IS THE SAME AS WHAT WAS IN A (GIVEN BY THE
                ; CALLER).  OLD A IS STORED IN B, OLD B IS LOST.
                ;
                ; 'OTSTG' LOOKS FOR A BACK-ARROW, SINGLE QUOTE, OR DOUBLE
                ; QUOTE.  IF NONE OF THESE, RETURN TO CALLER.  IF BACK-ARROW,
                ; OUTPUT A CR WITHOUT A LF.  IF SINGLE OR DOUBLE QUOTE, PRINT
                ; THE STRING IN THE QUOTE AND DEMANDS A MATCHING UNQUOTE.
                ; AFTER THE PRINTING THE NEXT 3 BYTES OF THE CALLER IS SKIPPED
                ; OVER (USUALLY A JUMP INSTRUCTION).
                ;
                ; 'PRTNUM' PRINTS THE NUMBER IN HL.  LEADING BLANKS ARE ADDED
                ; IF NEEDED TO PAD THE NUMBER OF SPACES TO THE NUMBER IN C.
                ; HOWEVER, IF THE NUMBER OF DIGITS IS LARGER THAN THE # IN
                ; C, ALL DIGITS ARE PRINTED ANYWAY.  NEGATIVE SIGN IS ALSO
                ; PRINTED AND COUNTED IN, POSITIVE SIGN IS NOT.
                ;
                ; 'PRTLN' PRINTS A SAVED TEXT LINE WITH LINE # AND ALL.
                ;
                PRTSTG:
0560 47                 MOV  B,A        ;*** PRTSTG ***
0561 1A         PS1:    LDAX D          ;GET A CHARACTER
0562 13                 INX  D          ;BUMP POINTER
0563 B8                 CMP  B          ;SAME AS OLD A?
0564 C8                 RZ              ;YES, RETURN
0565 D7                 RST  2          ;ELSE PRINT IT
0566 FE0D               CPI  CR         ;WAS IT A CR?
0568 C26105             JNZ  PS1        ;NO, NEXT
056B C9                 RET             ;YES, RETURN
                ;
056C CF         OTSTG:  RST  1          ;*** OTSTG ***
056D 22                 DB   '"'
056E 0F                 DB   OT2-$-1
056F 3E22               MVI  A,22H      ;IT IS A "
0571 CD6005     OT1:    CALL PRTSTG     ;PRINT UNTIL ANOTHER
0574 FE0D               CPI  CR         ;WAS LAST ONE A CR?
0576 E1                 POP  H          ;RETURN ADDRESS
0577 CA4701             JZ   RUNNXL     ;WAS CR, RUN NEXT LINE
057A 23         OT2:    INX  H          ;SKIP 3 BYTES ON RETURN
057B 23                 INX  H
057C 23                 INX  H
057D E9                 PCHL            ;RETURN
057E CF         OT3:    RST  1          ;IS IT A ' ?
057F 27                 DB   27H
0580 05                 DB   OT4-$-1
0581 3E27               MVI  A,27H      ;YES, DO SAME
0583 C37105             JMP  OT1        ;AS IN "
0586 CF         OT4:    RST  1          ;IS IT BACK-ARROW?
0587 5F                 DB   5FH
0588 08                 DB   OT5-$-1
0589 3E8D               MVI  A,8DH      ;YES, CR WITHOUT LF
058B D7                 RST  2          ;DO IT TWICE TO GIVE
058C D7                 RST  2          ;TTY ENOUGH TIME
058D E1                 POP  H          ;RETURN ADDRESS
058E C37A05             JMP  OT2
0591 C9         OT5:    RET             ;NONE OF ABOVE
                ;
                PRTNUM:
0592 0600               MVI  B,0        ;*** PRTNUM ***
0594 CD9204             CALL CHKSGN     ;CHECK SIGN
0597 F29D05             JP   PN1        ;NO SIGN
059A 062D               MVI  B,'-'      ;B=SIGN
059C 0D                 DCR  C          ;'-' TAKES SPACE
059D D5         PN1:    PUSH D          ;SAVE
059E 110A00             LXI  D,0AH      ;DECIMAL
```

Babylon-Pac super SALE!

Each pac only $1.98

All pacs are first quality (no fallout), tested and guaranteed.

Linear pac — 8 assorted linears in mini-DIP or TO-5*741 op amp, LM307 op amp, LM 703 RF-IF amp, with data and circuits $1.98

Flip-Flop pac — 10 assorted Flip-Flops, Dual JK's, RST's, and low power FF's, with data $1.98

Regulators — 4 LM723 DIP variable regulators, 2-40V, with data $1.98

739 pac — 5 Linears--dual low noise stereo amplifier 739. With data. $1.98

DIP RC Network — 50 assorted 14 and 16 pin IC packages containing precision resistors and capacitors-no data available $1.98

Transistor pac — 40 assorted TO-92 plastic transistors--PNP's and NPN's, mostly Fairchild house marked. $1.98

15 TTL Gates — assorted DIP's 7400 series-7420, 7430, 7440, etc...All prime, marked parts, with data $1.98

LED pac — 10 assorted discrete LED's-green, red, and infra-red, with data. $1.98

Comparator pac — 5 assorted DIP's--LM311, 710, 711, with data $1.98

Silicon Diode pac — 40 Silicon Signal Diodes PRV better than 200V!! Leads trimmed for PCB mounting. $1.98

Capacitors — 20 25mfd 6V tantalum capacitors-5/16"x1/4" x1/8"-Long leads, PCB mount. Some unmarked. Ideal for TTL logic. $1.98

TIP31A pac — 5 TIP31A NPN Power Transistor: HFE-30; IC-3A; VCEO-60V; 40W. Power tab w/ formed leads. $1.98

100 Diodes — Germanium computer signal diodes with leads trimmed for PCB mounting. $1.98

Linear pac — 8 assorted linears in mini-DIP or TO-5*741 op amp, LM307 op amp, LM 703 RF-IF amp, with data and circuits $1.98

100 Resistors — ¼w 5% resistors of any single standard value from 2.7 ohm to 1M ohm. Not an ass't. $1.98

Trimpots. — 12 Miniature & subminiature PCB potentiometers, assorted values from 1K to 25K, by Piher, Stackpole, etc. $1.98

UNTESTED PACS

CMOS pac — 30 Untested CMOS ICs. All factory marked-- $1.98

Transistors — 40 assorted GE power tab series--NPN, PNP and some Darlington. Untested, pin connections supplied. $1.98

Axial Rectifiers — 30 Axial Rectifiers, untested, 1 Amp--1200V+. Cosmetic rejects due to poor plating. $1.98

IC Assortment — 100 Untested ICs, all DIP, mostly TTL--some marked, housemarked, or unmarked. $1.98

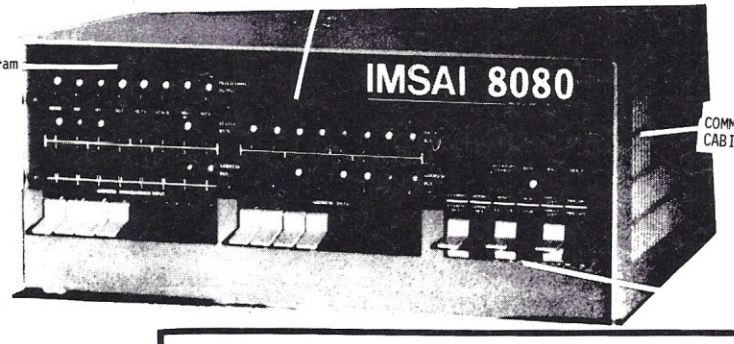
25 TTL 270 — Quad 2 input NAND gates, pin compatible with SN7400. Current drain ⅛ of 7400 and speed is less. New units branded Signetic and marked "270". $1.98 with data

Buy 5 pacs for $9.90 and pic-a-pac for 10¢

GET YOUR IMSAI BASIC COMPUTER SYSTEM BY PURCHASING IT AS THREE KITS OVER A THREE MONTH PERIOD!!

FRONT PANEL HOSTS A PHOTOGRAPHIC LEGEND TO PRODUCE A CLEAR, CONCISE, EASY-TO-READ FORMATT. (IT WON'T WEAR OFF).

8 additional program controlled LED's.

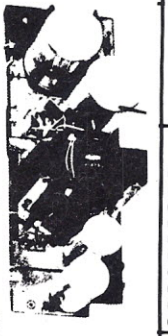


COMMERCIAL GRADE CABINET

BASIC SYSTEM
* Front panel and control board (CP-A)
* Chassis with 22 slot card card cage
* Sturdy attractive dust cover (DC)
* Microprocessor board (MPU-A)
* 28 Ampere power supply (PS-28)
* Mother board with 6 board slots
* Two 100 pin edge connectors (EXPM)
* IMSAI 8080 Systems User's Manual
* INTEL 8080 Microprocessor Manual
* An Introduction to Computers
* Software including monitor, assembler editor, loader and debugger (punched paper tape and source listing)

$199 per month plus $6 packing and shipping (California residents add sales tax)

Kits will be shipped promptly via UPS or Parcel Post-
KITS ARE NOT AVAILABLE SEPARATELY - YOU MUST PURCHASE KITS IN THE ORDER AS SHOWN.....



FIRST MONTH-
* IMSAI 8080 Microcomputer System User's Manual
* INTEL 8080 Manual completely describing the IC's used and the instruction set....
* An Introduction to Microcomputers a fundamental textbook...
* Front panel assembly with PC board, chips, switches, etc...

SECOND MONTH-
* MPU board with all components including crystal, chip set and other parts.

THIRD MONTH-
* Power supply, cabinet and all other material to complete delivery of the basic system as described.....


(MPU-A)

(PS-28)

7400 dip

7400	$.16	74L72	.60		
74H00	.18	7473	.25		
7401	.16	74L73	.75		
7402	.21	7474	.30		
7404	.18	74H74	.75		
74H04	.30	7475	.50		
7405	.24	7476	.30		
7406	.25	74L78	.70		
7408	.25	7480	.50		
74H08	.30	7483	.50		
7410	.18	7490	.50		
74H10	.30	7492	.35		
7413	.45	7493	.55		
7417	.35	7495	.65		
7420	.16	74L95	1.00		
74L20	.25	74107	.25		
74H20	.18	74110	1.00		
74H22	.30	74123	.75		
7426	.29	74125	1.00		
7430	.16	74145	1.10		
74H30	.30	74154	1.00		
74L30	.30	74155	.90		
7440	.15	74157	.90		
7441	.89	74163	.90		
7442	.50	74164	1.20		
7447	.80	74165	1.00		
7448	.80	74166	1.40		
7450	.16	74174	1.00		
74H50	.30	74177	.80		
7451	.16	74178	1.00		
74H51	.25	74180	1.00		
7453	.16	74192	.90		
74L54	.25	74193	1.00		
74L55	.25	74197	.80		
7460	.16	75491	1.00		
74L71	.20	75492	1.00		
7472	.40				

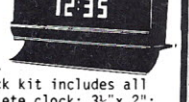
CMOS

CD4001	$.29	CD4029	2.25
CD4002	.29	CD4030	.65
CD4009	.59	CD4042	1.50
CD4010	.59	74C20	.65
CD4011	.29	74C42	2.00
CD4012	.29	74C160	2.50
CD4013	.69	74C195	2.25
CD4015	1.90	74C74	1.00
CD4016	.69	74C151	2.50
CD4019	.69		

NATIONAL MOS TO-5

STATIC SHIFT REGISTERS
MM504 dual 16 bit $1.50
MM505 dual 32 bit 1.75
MM550 dual differential analog switch 2.50
DYNAMIC SHIFT REGISTERS
MM502 dual 50 bit $1.25
MM506 dual 100 bit 1.75
MM5006 dual 100 bit 1.50
MM5013 1024 bit 2.25

SPACE AGE CLOCK KIT



Instructions & parts - 12 or 24 hour format.
Four digit clock kit includes all parts for complete clock: 3½"x 2":
-FND 70 readouts
-MM5314 clock chip & all transistors, etc.
-extruded aluminum case
-cord with transformer plug
$16.95

BOOKS

Learn Microprocessing!

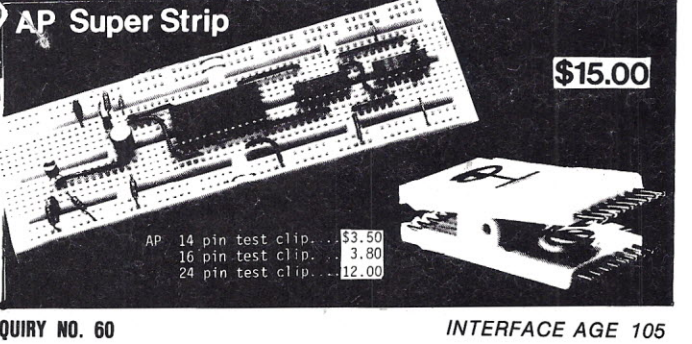
I An Introduction to Microcomputers by Adam Osborne $7.50
II An Introduction to Microcomputers Volume II:Some Real Products $12.50
III 8080 Programming for Logic Design by Adam Osborne $7.50
Complete Set of Three for $25.00

TRANSISTORS

2N4248-HEP715, PNP, 40V. Each 15¢ 10/$1.00
2N2222-NPN, 1.8W, 40V Each 20¢ 10/$1.75
2N5964-HEPS0005, NPN 150V. Each 15¢ 10/$1.00
2N4400-NPN, 40V. Each 15¢ 10/$1.35

AP Super Strip

$15.00



AP 14 pin test clip. . . $3.50
16 pin test clip. . . 3.80
24 pin test clip. . . 12.00

MONEY BACK GUARANTEE ON ALL GOODS!

Orders under $7.00 add $1.00 postage and handling. Residents of Cal. add sales tax. Orders shipped promptly. $10 minimum on C.O.D.s.

Phone (916)334-2161

4811 Myrtle Ave. Sacramento, CA

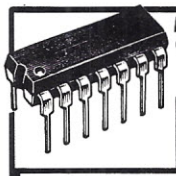
Mail orders to: P.O. Box 41778 Sacramento, CA 95841

Send a stamp for our flyer listing more money-saving bargains!

BABYLON ELECTRONICS

BANKAMERICARD

```
05A1 D5             PUSH D          ;SAVE AS A FLAG
05A2 0D             DCR  C          ;C=SPACES
05A3 C5             PUSH B          ;SAVE SIGN & SPACE
05A4 CD6604   PN2.  CALL DIVIDE     ;DEVIDE HL BY 10
05A7 78             MOV  A,B        ;RESULT 0?
05A8 B1             ORA  C
05A9 CAB405         JZ   PN3        ;YES, WE GOT ALL
05AC E3             XTHL            ;NO, SAVE REMAINDER
05AD 2D             DCR  L          ;AND COUNT SPACE
05AE E5             PUSH H          ;HL IS OLD BC '
05AF 60             MOV  H,B        ;MOVE RESULT TO BC
05B0 69             MOV  L,C
05B1 C3A405         JMP  PN2        ;AND DIVIDE BY 10
05B4 C1       PN3:  POP  B          ;WE GOT ALL DIGITS IN
05B5 0D       PN4:  DCR  C          ;THE STACK
05B6 79             MOV  A,C        ;LOOK AT SPACE COUNT
05B7 B7             ORA  A
05B8 FAC105         JM   PN5        ;NO LEADING BLANKS
05BB 3E20           MVI  A,20H      ;LEADING BLANKS
05BD D7             RST  2
05BE C3B505         JMP  PN4        ;MORE?
05C1 78       PN5:  MOV  A,B        ;PRINT SIGN
05C2 B7             ORA  A
05C3 C41000         CNZ  10H
05C6 5D             MOV  E,L        ;LAST REMAINDER IN E
05C7 7B       PN6:  MOV  A,E        ;CHECK DIGIT IN E
05C8 FE0A           CPI  0AH        ;10 IS FLAG FOR NO MORE
05CA D1             POP  D
05CB C8             RZ              ;IF SO, RETURN
05CC C630           ADI  30H        ;ELSE COVERT TO ASCII
05CE D7             RST  2          ;AND PRINT THE DIGIT
05CF C3C705         JMP  PN6        ;GO BACK FOR MORE
                    ;
05D2 1A       PRTLN: LDAX D         ;*** PRTLN ***
05D3 6F             MOV  L,A        ;LOW ORDER LINE #
05D4 13             INX  D
05D5 1A             LDAX D          ;HIGH ORDER
05D6 67             MOV  H,A
05D7 13             INX  D
05D8 0E04           MVI  C,4H       ;PRINT 4 DIGIT LINE #
05DA CD9205         CALL PRTNUM
05DD 3E20           MVI  A,20H      ;FOLLOWED BY A BLANK
05DF D7             RST  2
05E0 97             SUB  A          ;AND THEN THE TEXT
05E1 CD6005         CALL PRTSTG
05E4 C9             RET
                    ;
                    ;*************************************************************
                    ;
                    ; *** MVUP *** MVDOWN *** POPA *** & PUSHA ***
                    ;
                    ; 'MVUP' MOVES A BLOCK UP FROM WHERE DE-> TO WHERE BC-> UNTIL
                    ; DE = HL
                    ;
                    ; 'MVDOWN' MOVES A BLOCK DOWN FROM WHERE DE-> TO WHERE HL->
                    ; UNTIL DE = BC
                    ;
                    ; 'POPA' RESTORES THE 'FOR' LOOP VARIABLE SAVE AREA FROM THE
                    ; STACK
                    ;
                    ; 'PUSHA' STACKS THE 'FOR' LOOP VARIABLE SAVE AREA INTO THE
                    ; STACK
                    ;
05E5 E7       MVUP:  RST  4         ;*** MVUP ***
05E6 C8              RZ             ;DE = HL, RETURN
05E7 1A              LDAX D         ;GET ONE BYTE
05E8 02              STAX B         ;MOVE IT
05E9 13              INX  D         ;INCREASE BOTH POINTERS
05EA 03              INX  B
05EB C3E505          JMP  MVUP      ;UNTIL DONE
                     ;
                     MVDOWN:
05EE 78              MOV  A,B       ;*** MVDOWN ***
05EF 92              SUB  D         ;TEST IF DE = BC
05F0 C2F505          JNZ  MD1       ;NO, GO MOVE
05F3 79              MOV  A,C       ;MAYBE, OTHER BYTE?
05F4 93              SUB  E
05F5 C8              RZ             ;YES, RETURN
05F6 1B       MD1:   DCX  D         ;ELSE MOVE A BYTE
05F7 2B              DCX  H         ;BUT FIRST DECREASE
05F8 1A              LDAX D         ;BOTH POINTERS AND
05F9 77              MOV  M,A       ;THEN DO IT
05FA C3EE05          JMP  MVDOWN    ;LOOP BACK
                     ;
05FD C1       POPA:  POP  B         ;BC = RETURN ADDR.
05FE E1              POP  H         ;RESTORE LOPVAR, BUT
05FF 220910          SHLD LOPVAR    ;=0 MEANS NO MORE
0602 7C              MOV  A,H
0603 B5              ORA  L
0604 CA1706          JZ   PP1       ;YEP, GO RETURN
0607 E1              POP  H         ;NOP, RESTORE OTHERS
0608 220610          SHLD LOPINC
060B E1              POP  H
060C 220D10          SHLD LOPLMT
060F E1              POP  H
0610 220F10          SHLD LOPLN
0613 E1              POP  H
0614 221110          SHLD LOPPT
0617 C5       PP1:   PUSH B         ;BC = RETURN ADDR.
0618 C9              RET
                     ;
0619 21DE13   PUSHA: LXI  H,STKLMT ;*** PUSHA ***
061C CD0604          CALL CHGSGN
                     ;
061F C1              POP  B         ;BC=RETURN ADDRESS
0620 39              DAD  SP        ;IS STACK NEAR THE TOP?
0621 D2F304          JNC  OSORRY    ;YES, SORRY FOR THAT.
0624 2A0910          LHLD LOPVAR    ;ELSE SAVE LOOP VAR.S
0627 7C              MOV  A,H       ;BUT IF LOPVAR IS 0
0628 B5              ORA  L         ;THAT WILL BE ALL
0629 CA2F06          JZ   PU1
062C 2A1110          LHLD LOPPT     ;ELSE, MORE TO SAVE
062F E5              PUSH H
0630 2A0F10          LHLD LOPLN
0633 E5              PUSH H
0634 2A0D10          LHLD LOPLMT
0637 E5              PUSH H
0638 2A0B10          LHLD LOPINC
063B E5              PUSH H
063C 2A0910          LHLD LOPVAR
063F E5       PU1:   PUSH H
0640 C5              PUSH B         ;BC = RETURN ADDR.
0641 C9              RET
                     ;
                     ;*************************************************************
                     ;
                     ; *** OUTC *** & CHKIO ***
                     ;
                     ; THESE ARE THE ONLY I/O ROUTINES IN TBI.
                     ; 'OUTC' IS CONTROLLED BY A SOFTWARE SWITCH 'OCSW'.  IF OCSW=0
                     ; 'OUTC' WILL JUST RETURN TO THE CALLER.  IF OCSW IS NOT 0,
                     ; IT WILL OUTPUT THE BYTE IN A.  IF THAT IS A CR, A LF IS ALSO
                     ; SEND OUT.  ONLY THE FLAGS MAY BE CHANGED AT RETURN, ALL REG.
                     ; ARE RESTORED.
                     ;
                     ; 'CHKIO' CHECKS THE INPUT.  IF NO INPUT, IT WILL RETURN TO
                     ; THE CALLER WITH THE Z FLAG SET.  IF THERE IS INPUT, Z FLAG
                     ; IS CLEARED AND THE INPUT BYTE IS IN A.  HOWERER, IF THE
                     ; INPUT IS A CONTROL-O, THE 'OCSW' SWITCH IS COMPLIMENTED, AND
                     ; Z FLAG IS RETURNED.  IF A CONTROL-C IS READ, 'CHKIO' WILL
                     ; RESTART TBI AND DO NOT RETURN TO THE CALLER.
                     ;
                     OUTC   PUSH AF        THIS IS AT LOC. 10
                        ;   LD   A,OCSW    CHECK SOFTWARE SWITCH
                        ;   IOR  A
0642 320010   INIT:  STA  OCSW
0645 3ECF            MVI  A,0CFH
0647 D3FB,           OUT  0FBH
0649 3E27            MVI  A,27H
064B D3FB            OUT  0FBH
064D 1619            MVI  D,19H
              PATLOP:
064F CD0E00          CALL CRLF
0652 15              DCR  D
0653 C24F06          JNZ  PATLOP
0656 97              SUB  A
0657 11A206          LXI  D,MSG1
065A CD6005          CALL PRTSTG
065D 210000          LXI  H,START
0660 221310          SHLD RANPNT
0663 211710          LXI  H,TXTBGN
0666 221510          SHLD TXTUNF
0669 C3BA00          JMP  RSTART
066C C27106   OC2:   JNZ  OC3        ;IT IS ON
066F F1 ,            POP  PSW        ;IT IS OFF
0670 C9              RET             ;RESTORE AF AND RETURN
0671 DBFB     OC3:   IN   0FBH       ;COME HERE TO DO OUTPUT
0673 E601            ANI  1H         ;STATUS BIT
0675 CA7106          JZ   OC3        ;NOT READY, WAIT
0678 F1              POP  PSW        ;READY, GET OLD A BACK
0679 D3FA            OUT  0FAH       ;AND SEND IT OUT
067B FE0D            CPI  CR         ;WAS IT CR?
067D C0              RNZ             ;NO, FINISHED
067E 3E0A            MVI  A,LF       ;SEND LF
0680 D7              RST  2          ;THIS IS RECURSIVE
0681 3E0D            MVI  A,CR       ;GET CR BACK IN A
0683 C9              RET
0684 DBFB     CHKIO: IN   0FBH       ;*** CHKIO ***
0686 00              NOP             ;STATUS BIT FLIPPED?
0687 E602            ANI  2H         ;MASK STATUS BIT
0689 C8              RZ              ;NOT READY, RETURN "Z"
068A DBFA            IN   0FAH       ;READY, READ DATA
068C E67F            ANI  7FH        ;MASK BIT 7 OFF
068E FE0F            CPI  0FH        ;IS IT CONTROL-O?
0690 C29D06          JNZ  CI1        ;NO, MORE CHECKING
0693 3A0010          LDA  OCSW       ;CONTROL-O FLIPS OCSW
0696 2F              CMA             ;ON TO OFF, OFF TO ON
0697 320010          STA  OCSW
069A C38406          JMP  CHKIO      ;GET ANOTHER INPUT
069D FE03     CI1:   CPI  3H         ;IS IT CONTROL-C?
069F C0              RNZ             ;NO, RETURN "NZ"
06A0 C3BA00          JMP  RSTART     ;YES, RESTART TBI
06A3 54494E59 MSG1:  DB  'TINY '
06A7 20
06A8 42415349        DB  'BASIC'
06AC 43
06AD 0D              DB  CR
                     ;
                     ;*************************************************************
                     ;
                     ; *** TABLES *** DIRECT *** & EXEC ***
                     ;
                     ; THIS SECTION OF THE CODE TESTS A STRING AGAINST A TABLE.
                     ; WHEN A MATCH IS FOUND, CONTROL IS TRANSFERED TO THE SECTION
                     ; OF CODE ACCORDING TO THE TABLE.
                     ;
                     ; AT 'EXEC', DE SHOULD POINT TO THE STRING AND HL SHOULD PO:
                     ; TO THE TABLE-1.  AT 'DIRECT', DE SHOULD POINT TO THE STRI!
                     ; HL WILL BE SET UP TO POINT TO TAB1-1, WHICH IS THE TABLE (
                     ; ALL DIRECT AND STATEMENT COMMANDS.
                     ;
                     ; A '.' IN THE STRING WILL TERMINATE THE TEST AND THE PARTIA
                     ; MATCH WILL BE CONSIDERED AS A MATCH.  E.G., 'P.', 'PR.',
                     ; 'PRI.', 'PRIN.', OR 'PRINT' WILL ALL MATCH 'PRINT'.
                     ;
                     ; THE TABLE CONSISTS OF ANY NUMBER OF ITEMS.  EACH ITEM
                     ; IS A STRING OF CHARACTERS WITH BIT 7 SET TO 0 AND
                     ; A JUMP ADDRESS STORED HI-LOW WITH BIT 7 OF THE HIGH
                     ; BYTE SET TO 1.
                     ;
                     ; END OF TABLE IS AN ITEM WITH A JUMP ADDRESS ONLY.  IF THE
                     ; STRING DOES NOT MATCH ANY OF THE OTHER ITEMS, IT WILL
                     ; MATCH THIS NULL ITEM AS DEFAULT.
                     ;
                     TAB1:              ;DIRECT COMMANDS
06AE 4C495354              DB  'LIST'
                     +     DWA LIST
06B2 81              +     DB      (0016FH SHR 8) +128
06B3 6F              +     DB      0016FH AND 0FFH
                     ;
06B4 52554E                DB  'RUN'
                     +     DWA RUN
06B7 81              +     DB      (00141H SHR 8) +128
06B8 41              +     DB      00141H AND 0FFH
                     ;
06B9 4E4557                DB  'NEW'
                     +     DWA NEW
06BC 81              +     DB      (00132H SHR 8) +128
06BD 32              +     DB      00132H AND 0FFH
                     ;
                     TAB2:              ;DIRECT/STATEMENT
06BE 4E455854              DB  'NEXT'
                     +     DWA NEXT
06C2 82              +     DB      (00257H SHR 8) +128
06C3 57              +     DB      00257H AND 0FFH
                     ;
06C4 4C4554                DB  'LET'
                     +     DWA LET
06C7 83              +     DB      (00323H SHR 8) +128
06C8 23              +     DB      00323H AND 0FFH
                     ;
06C9 4946                  DB  'IF'
                     +     DWA IFF
06CB 82              +     DB      (002B4H SHR 8) +128
                     ;
06CC B4              +     DB      002B4H AND 0FFH
                     ;
06CD 474F544F              DB  'GOTO'
                     +     DWA GOTO
06D1 81              +     DB      (00160H SHR 8) +128
06D2 60              +     DB      00160H AND 0FFH
                     ;
06D3 474F5355              DB  'GOSUB'
06D7 42
                     +     DWA GOSUB
06D8 81              +     DB      (001BFH SHR 8) +128
06D9 BF              +     DB      001BFH AND 0FFH
```



DIGI-KEY CORPORATION

Quality Electronic Components

Double-Digit Discounts

Save You Even More

2102-1	8080A	LM3909
$1.99	$24.95	69¢

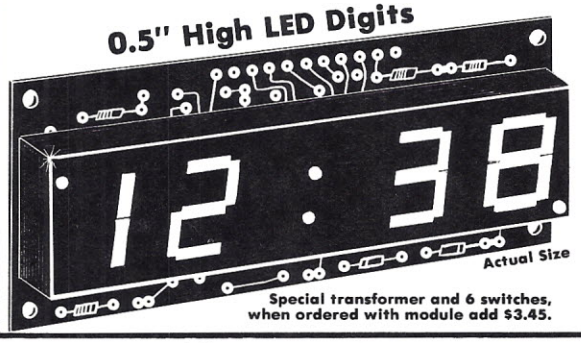
NATIONAL SEMICONDUCTOR CLOCK MODULES

NATIONAL

MA1010A 12 Hour (AM-PM) Version . . . $13.00
MA1010C 24 Hour Version $13.00

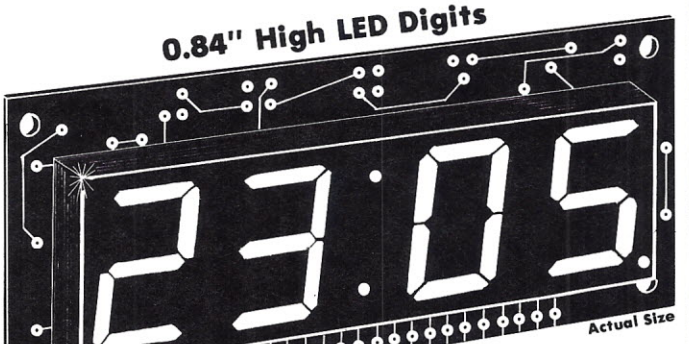
MA1002A 12 Hour (AM-PM) Version $10.50
MA1002C 24 Hour Version. $10.50

0.5" High LED Digits



Special transformer and 6 switches, when ordered with module add $3.45.

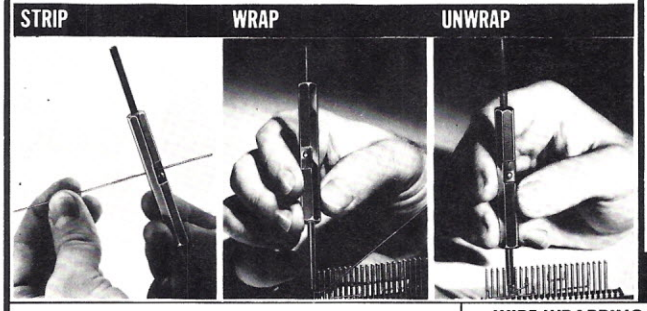
0.84" High LED Digits



Special transformer and 6 switches when ordered with module add $3.45

Hobby-Wrap-30 $5.95

Strips, Wraps and Unwraps 30 ga. wire on standard wire wrapping pins



MA1002 & MA1010 Series Electronic Clock Modules

NATIONAL

The MA1002 & MA1010 Series Electronic Clock Modules are assembled and pretested modules which combine a monolithic MOS-LSI integrated clock circuit, 4-digit LED display, power supply and other associated discrete components on a single printed circuit board to form a complete electronic clock movement. The user need add only a transformer and switches to construct a digital clock for application in clock-radios, alarm or instrument panel clocks. Timekeeping may be from 50 or 60 Hz inputs and 12 or 24 hour display formats may be chosen. Direct LED drive eliminates RF interference. Time setting is made easy through use of "Fast" and "Slow" scanning controls.

The MA1002A and MA1010A have a 12 hour display with an AM and PM indicator. The MA1002C and MA1010C have a 24 hour display.

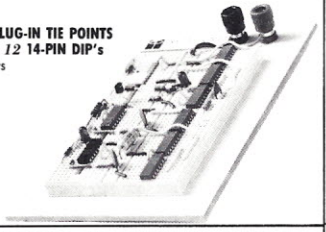
Features include alarm "on" and "PM" indicators, "sleep" and "snooze" timers and variable brightness control capability. The modules are extremely compact, the MA1002 measuring 1.375" by 3.05", the MA1010 measuring 1.75" by 3.75". This small size is achieved by bonding the I.C. to the back of the circuit board.

It is highly recommended that the transformer be obtained with the clock module as it is a special dual secondary type not otherwise readily available.

Double Digit Discounts Save You Even More!

ACE201-K
$24.95

1,032 SOLDERLESS PLUG-IN TIE POINTS
CAPACITY: *UP TO 12* **14-PIN DIP's**
TWO 5-way binding posts
Size: 4-9/16" by 7"
Kit form



WIRE WRAPPING WIRE

Red or Black Kynar insulated pre-cut and stripped 30 ga. wire. 1" of insulation is removed from each end.

Insulation Length	No. in Pkg.	Price per Pkg.
1.0"	100	$2.50
2.0"	100	$2.60
2.5"	100	$2.65
3.0"	100	$2.70
3.5"	100	$2.75
4.0"	100	$2.80
4.5"	100	$2.90
5.0"	100	$3.00
6.0"	50	$1.60
7.0"	50	$1.70
8.0"	50	$1.80
9.0"	50	$1.90
10.0"	50	$2.00
15.0"	50	$2.50

SLIDE SWITCHES

Single Pole Single Throw
.15 1.20/10 10.00/C

Double Pole Double Throw
.23 2.00/10 19.00/C

BATTERY HOLDERS

1-AA . . . 26c
2-AA . . . 42c
1-C 35c
2-C 42c
1-D 35c
2-D 42c

BISHOP GRAPHICS Printed Circuit Drafting Aids are now available from Digi-Key

RADIAL ELECTROLYTICS

.47/50V . . .08	.65/10	22/50V. . . 12	1.00/10	330/25V . . 23	1.86/10
1/50V 08	.65/10	100/6.3V . .09	.75/10	470/10R . . 21	1.71/10
2.2/50V . . .08	.65/10	100/10V . . .10	.77/10	470/16V . . 23	1.81/10
3.3/50V . . .08	.65/10	100/16V . . .11	.85/10	470/25V . . 29	2.35/10
4.7/35V . . .08	.65/10	100/25V . . 13	1.10/10	1000/10V . 24	1.96/10
4.7/50V . . .08	.68/10	100/50V . . 21	1.71/10	1000/16V . 29	2.35/10
10/16V . . .08	.65/10	220/10V . . 13	1.08/10	1000/25V . 42	3.33/10
10/25V . . .08	.65/10	220/16V . . 15	1.16/10	2200/10V . 42	3.33/10
10/50V . . .10	.75/10	220/25V . . 21	1.71/10	2200/16V . 54	4.30/10
22/16V . . .08	.67/10	220/50V . . 29	2.35/10	2200/25V . 58	4.67/10
22/25V . . .09	.70/10	330/10V . . 15	1.16/10	3300/16V . 89	7.14/10
		330/16V . . 21	1.66/10		

AXIAL ELECTROLYTICS

.47/10V . . . 11	.90/10	33/25V. . . 14	1.15/10	330/16V . . 29	2.35/10
1/30V 11	.90/10	33/50V. . . 19	1.52/10	330/25V . . 32	2.54/10
3.3/35V . . 12	.95/10	47/16V. . . 14	1.15/10	470/16V . . 32	2.55/10
3.3/50V . . 12	1.00/10	47/25V. . . 17	1.30/10	470/25V . . 37	3.00/10
4.7/25V . . 11	.90/10	47/50V. . . 21	1.17/10	1000/10V . 33	2.65/10
4.7/35V . . 12	.95/10	100/10V . . 14	1.13/10	1000/16V . 39	3.15/10
4.7/50V . . 12	1.00/10	100/16V . . 17	1.30/10	1000/25V . 56	4.50/10
10/25V . . . 12	1.00/10	100/25V . . 20	1.55/10	2200/10V . 50	3.96/10
10/50V . . . 14	1.15/10	100/50V . . 29	2.30/10	2200/16V . 62	4.95/10
22/16V . . . 12	1.00/10	220/10V . . 18	1.42/10	2200/25V . 79	6.36/10
22/25V . . . 13	1.05/10	220/16V . . 20	1.55/10	3300/16V . 95	7.63/10
22/50V . . . 17	1.32/10	220/25V . . 29	2.35/10	4700/16V1.09	8.70/10
33/16V . . . 12	1.00/10	220/50V . . 40	3.23/10	10000/10V 1.15	9.19/10
		330/10V . . 14	1.16/10		

INTEGRATED CIRCUITS — TTL, CMOS, LINEAR & MOS

7400 .21	7476 .32	74181 2.15	4012 .23	4520 1.14			
7401 .21	7480 .70	74182 .79	4013 .40	4527 1.68			
7402 .21	7482 .70	74184 2.19	4014 .96	4528 .88			
7403 .21	7483 .70	74185 2.19	4015 .96	4585 1.23			
7404 .21	7485 .89	74188 3.50	4016 .40	2102-1 1.99			
7405 .21	7486 .28	74189 3.50	4017 1.05	8080A 24.95			
7406 .25	7489 2.19	74190 1.23	4018 1.05	CA3046 .75			
7407 .25	7490 .44	74191 1.23	4019 .23	LM2111N 1.25			
7408 .21	7491 .70	74192 .88	4020 1.14	LM309K 1.80			
7409 .21	7492 .44	74193 .88	4021 1.14	LM324A 1.28			
7410 .21	7493 .44	74194 .88	4022 .96	LM340T-5 1.25			
7411 .21	7494 .70	74195 .88	4023 .23	LM340T-6 1.25			
7412 .21	7495 .70	74196 .88	4024 .84	LM340T-8 1.25			
7413 .25	7496 .70	74197 .88	4025 .23	LM340T-12 1.25			
7414 .89	74100 1.28	74198 1.49	4026 1.68	LM340T-15 1.25			
7416 .25	74107 .30	74199 1.49	4027 .40	LM340T-18 1.25			
7417 .25	74109 .33	74251 1.09	4028 .89	LM340T-24 1.25			
7420 .21	74121 .35	74279 .55	4029 1.14	LM3900N .88			
7421 .25	74122 .44	74365 .67	4030 .23	LM3909N .69			
7423 .35	74123 .61	74366 .67	4033 1.51	MC1456V 1.00			
7425 .35	74125 .40	74367 .67	4034 3.50	MC1458V .53			
7426 .25	74126 .40	74368 .67	4035 1.14	MC3302P 1.15			
7427 .33	74132 .70	8093 .40	4040 1.14	NE536T 3.24			
7428 .28	74141 .88	8094 .40	4041 .79	NE540L 2.04			
7430 .21	74145 .70	9095 .67	4042 .79	NE555V .48			
7432 .25	74147 1.63	8096 .67	4043 .70	NE556A .88			
7433 .30	74148 1.30	8097 .67	4044 .70	NE560B 3.83			
7437 .25	74150 1.16	8098 .67	4046 1.86	NE561B 3.83			
7438 .25	74151 .70	75150 1.16	4049 .40	NE562B 3.83			
7440 .21	74153 .65	75450 .88	4050 .40	NE565A 1.25			
7442 .53	74154 1.03	75451 .61	4051 1.26	NE566V 1.28			
7443 .63	74155 .70	75452 .61	4052 1.26	NE567V 1.36			
7445 .70	74156 .70	75453 .61	4053 1.26	uA709CV .44			
7446 .70	74157 .70	75454 .61	4060 1.58	uA710CA .44			
7447 .70	74160 .88	75491 .81	4066 .79	uA711CA .53			
7448 .70	74161 .88	75492 .84	4071 .23	uA723CA .60			
7450 .21	74162 .88	75493 1.09	4072 .23	uA733CA .75			
7451 .21	74163 .88	75494 1.19	4073 .23	uA741CV .44			
7453 .21	74164 .96	82525 2.19	4075 .23	uA747CA .70			
7454 .21	74165 1.15	4000 .23	4081 .23	uA748CV .49			
7459 .21	74166 1.26	4001 .23	4082 .23	uA7805CU 1.25			
7460 .21	74170 2.64	4002 .23	4502 .79	uA7806CU 1.25			
7470 .30	74173 1.42	4006 1.23	4510 1.14	uA7808CU 1.25			
7472 .30	74174 .98	4007 .23	4511 1.05	uA7812CU 1.25			
7473 .30	74175 .93	4008 .79	4514 2.80	uA7815CU 1.25			
7474 .30	74176 .79	4009 .44	4515 2.80	uA7818CU 1.25			
7475 .49	74177 .79	4010 .44	4516 1.23	uA7824CU 1.25			
	74180 .70	4011 .23	4518 1.14				

SILICON TRANSISTORS

MPS918, MPS930, MPS2222A, MPS2369A, MPS2712, MPS2907A, MPS3392, MPS3393, MPS3394, MPS3395, MPS3563, MPS3565, MPS3638, MPS3638A, MPS3640, MPS3641, MPS3643, MPS3645, MPS3646, 2N3904, 2N3906, 2N4124, 2N4126, 2N4401, 2N4403, 2N4410, PN4888, 2N5087, 2N5089, PN5129, PN5133, PN5134, PN5137, PN5138, PN5139, 2N5210, PN5964 16, $1.55/10, $13.60/100 of same part no.

MPF102 .36 $30.60/C 2N5457 .48 $41.00/C MPSA13 .28 $24.00/C 2N3055 .99 $85.00/C

WIRE WRAPPING WIRE IN BULK

Red or Black 30 ga. Kynar

100' $2.00 500' $8.50 1000' $15.00

ENTIRE ROCKWELL CALCULATOR LINE ON DISCOUNT IN OUR LATEST CATALOG



MOLEX PINS

Make your own IC sockets on PC board

.85/C 8.20/M 38.20/5M 275.00/50M

SILICON DIODES

1N4001	.64/10	5.50/C	$49/M
1N4002	.66/10	5.60/C	$51/M
1N4003	.68/10	5.80/C	$52/M
1N4004	.70/10	5.95/C	$54/M
1N4005	.82/10	7.05/C	$63/M
1N4006	.90/10	7.75/C	$69/M
1N4007	.99/10	8.60/C	$77/M
1N4148	.40/10	3.50/C	$29/M

Double Digit Discounts Save You Even More!

RESISTOR ASSORTMENTS

5 ea all 10% ¼ w. val. 10 thru 5.6 meg (350 pcs) $12.00
5 ea all 10% ½ w. val. 2.2 thru 22 meg (425 pcs) $12.00

½ WATT ZENER DIODES

1N5226B 3.3v .15 $11/C	1N5236B 7.5v .15 $11/C
1N5227B 3.6v .15 $11/C	1N5237B 8.2v .15 $11/C
1N5228B 3.9v .15 $11/C	1N5238B 8.7v .15 $11/C
1N5229B 4.3v .15 $11/C	1N5239B 9.1v .15 $11/C
1N5230B 4.7v .15 $11/C	1N5240B 10v .15 $11/C
1N5231B 5.1v .15 $11/C	1N5241B 11v .15 $11/C
1N5232B 5.6v .15 $11/C	1N5242B 12v .15 $11/C
1N5233B 6.0v .15 $11/C	1N5243B 13v .15 $11/C
1N5234B 6.2v .15 $11/C	1N5244B 14v .15 $11/C
1N5235V 6.8v .15 $11/C	1N5245B 15v .15 $11/C

PERF BOARD

0.1" spacing between holes

4½"x 6" $1.71
4½"x17" $4.25

TERMINALS

for above perf board

$1.50/C

LED LAMPS

NSL5053 T-1 ¾ .18 $15/C
NSL5056 T-1 ¾ .18 $15/C

LED DISPLAYS

FND357 CC .375" . . $1.75
FND500 CC .500" . . $1.75
FND 507 CA .500 . . $1.75
FND800 CC .800" . . $3.50
FND807 CA .800" . . $3.50

DATA BOOKS



DATA BOOKS

TTL IC's 595 p. $4.00
Linear IC's 957 p. $5.00
CMOS IC's 256 p. $3.00
Transistors 288 p. $3.00
Memory IC's 592 p. $3.00
Interface IC's 464 p. $4.00
Volt. Regs. 128 p. $3.00
Linear Appl. 1 432 p. $4.00
Linear Appl. 2 246 p. $3.00
Audio 196 p. $3.00

WIRE-WRAPPING TOOL

$5.95

Wraps, Unwraps & Strips 30 ga. Wire

¼ & ½ WATT 5% CARBON FILM RESISTORS

5¢ each in multiples of 5 per value
$1.70/100 & $12.00/1000 of same value

1 ohm thru 1.0 megohm

I.C. SOCKETS

8 Pin Solder	.17	1.60/10
14 Pin Solder	.20	1.90/10
16 Pin Solder	.22	2.10/10
18 Pin Solder	.29	2.75/10
24 Pin Solder	.38	3.60/10
28 Pin Solder	.45	4.25/10
40 Pin Solder	.63	6.00/10
8 Pin W-W	.24	2.30/10
14 Pin W-W	.26	2.50/10
16 Pin W-W	.30	2.85/10
18 Pin W-W	.60	5.70/10
24 Pin W-W	.96	9.10/10
28 Pin W-W	1.12	10.00/10
40 Pin W-W	.92	8.75/10

HARDWARE

2-56 1/4 Screw	.99/C	7.20/M
2-56 1/2 Screw	.99/C	7.65/M
4-40 1/4 Screw	.55/C	3.60/M
4-40 1/2 Screw	.60/C	4.05/M
6-32 1/4 Screw	.65/C	4.40/M
6-32 1/2 Screw	.75/C	4.85/M
8-32 3/8 Screw	.90/C	5.85/M
8-32 5/8 Screw	.99/C	7.00/M
2-56 Hex Nut	.55/C	3.60/M
4-40 Hex Nut	.55/C	3.75/M
6-32 Hex Nut	.60/C	4.00/M
8-32 Hex Nut	.60/C	4.15/M
No. 2 Lockwasher	.85/C	5.75/M
No. 4 Lockwasher	.45/C	3.00/M
No. 6 Lockwasher	.45/C	3.00/M
No. 8 Lockwasher	.45/C	3.00/M

DOUBLE-DIGIT DISCOUNT SCHEDULE

Merchandise	Discount	Merchandise	Discount
$ 0.00-$24.99	NET	$100.00-$499.99	Less 15%
		$500.00-$999.99	Less 20%
$25.99-$99.99	Less 10%	$1000.00 & Up	Less 25%

Then Add the Standard Charge Below

STANDARD SHIPPING/HANDLING CHARGE

If your merchandise total after discount is between

$ 0.00-$ 4.99 . . add $2.00 $ 50.00-$99.99 . . add $0.25
$ 5.00-$24.99 . . add $0.75 $100.00 & up . . No Charge
$25.00-$49.99 . . add $0.50

Includes shipping and insurance to USA & Canada

COD ORDERS ACCEPTED FOR SAME DAY SHIPMENT — CALL 218-681-6674

Send for free catalog or mail reader's service card

"Only Quality Components Sold!"

DON'T FORGET TO APPLY DISCOUNT SCHEDULE



DIGI-KEY CORPORATION

Box 677, Thief River Falls, MN 56701 218-681-6674

```
06DA 52455455          DB  'RETURN'
06DE 524E
                +      DWA RETURN
06E0 81         +      DB      (001DFH SHR 8) +128
06E1 DF         +      DB      001DFH AND 0FFH

06E2 52454D            DB  'REM'
                +      DWA REM
06E5 82         +      DB      (002B0H SHR 8) +128
06E6 B0         +      DB      002B0H AND 0FFH

06E7 464F52            DB  'FOR'
                +      DWA FOR
06EA 81         +      DB      (001F8H SHR 8) +128
06EB F8         +      DB      001F8H AND 0FFH

06EC 494E5055          DB  'INPUT'
06F0 54
                +      DWA INPUT
06F1 82         +      DB      (002CDH SHR 8) +128
06F2 CD         +      DB      002CDH AND 0FFH

06F3 5052494E          DB  'PRINT'
06F7 54
                +      DWA PRINT
06F8 81         +      DB      (00187H SHR 8) +128
06F9 87         +      DB      00187H AND 0FFH

06FA 53544F50          DB  'STOP'
                +      DWA STOP
06FE 81         +      DB      (0013BH SHR 8) +128
06FF 3B         +      DB      0013BH AND 0FFH

                +      DWA DEFLT
0700 83         +      DB      (0031DH SHR 8) +128
0701 1D         +      DB      0031DH AND 0FFH

                TAB4:                  ;FUNCTIONS
0702 524E44            DB  'RND'
                +      DWA RND
0705 84         +      DB      (00425H SHR 8) +128
0706 25         +      DB      00425H AND 0FFH

0707 414253            DB  'ABS'
                +      DWA ABS
070A 84         +      DB      (00450H SHR 8) +128
070B 50         +      DB      00450H AND 0FFH

070C 53495A45          DB  'SIZE'
                +      DWA SIZE
0710 84         +      DB      (00459H SHR 8) +128
0711 59         +      DB      00459H AND 0FFH

                +      DWA XP40
0712 84         +      DB      (0040BH SHR 8) +128
0713 0B         +      DB      0040BH AND 0FFH

                TAB5:                  ;"TO" IN "FOR"
0714 544F              DB  'TO'
                +      DWA FR1
0716 82         +      DB      (00208H SHR 8) +128
0717 08         +      DB      00208H AND 0FFH

                +      DWA QWHAT
0718 84         +      DB      (004C6H SHR 8) +128
0719 C6         +      DB      004C6H AND 0FFH

                TAB6:                  ;"STEP" IN "FOR"
071A 53544550          DB  'STEP'
                +      DWA FR2
071E 82         +      DB      (00212H SHR 8) +128
071F 12         +      DB      00212H AND 0FFH

                +      DWA FR3
0720 82         +      DB      (00216H SHR 8) +128
0721 16         +      DB      00216H AND 0FFH

                TAB8:                  ;RELATION OPERATORS
0722 3E3D              DB  '>='
                +      DWA XP11
0724 83         +      DB      (00333H SHR 8) +128
0725 33         +      DB      00333H AND 0FFH

0726 23                DB  '#'
                +      DWA XP12
0727 83         +      DB      (00339H SHR 8) +128
0728 39         +      DB      00339H AND 0FFH

0729 3E                DB  '>'
                +      DWA XP13
072A 83         +      DB      (0033FH SHR 8) +128
072B 3F         +      DB      0033FH AND 0FFH

072C 3D                DB  '='
                +      DWA XP15
072D 83         +      DB      (0034EH SHR 8) +128
072E 4E         +      DB      0034EH AND 0FFH

072F 3C3D              DB  '<='
                +      DWA XP14
0731 83         +      DB      (00346H SHR 8) +128
0732 46         +      DB      00346H AND 0FFH

0733 3C                DB  '<'
                +      DWA XP16
0734 83         +      DB      (00354H SHR 8) +128
0735 54         +      DB      00354H AND 0FFH

                +      DWA XP17
0736 83         +      DB      (0035AH SHR 8) +128
0737 5A         +      DB      0035AH AND 0FFH

                ;
                ;
                DIRECT:
0738 21AD06             LXI  H,TAB1-1 ;*** DIRECT ***
                ;
                EXEC:                  ;*** EXEC ***
073B EF         EX0:    RST  5         ;IGNORE LEADING BLANKS
073C D5                 PUSH D         ;SAVE POINTER
073D 1A         EX1:    LDAX D         ;IF FOUND '.' IN STRING
073E 13                 INX  D         ;BEFORE ANY MISMATCH
073F FE2E               CPI  2EH       ;WE DECLARE A MATCH
0741 CA5A07             JZ   EX3
0744 23                 INX  H         ;HL->TABLE
0745 BE                 CMP  M         ;IF MATCH, TEST NEXT
0746 CA2D07             JZ   EX1
0749 3E7F               MVI  A,07FH    ;ELSE, SEE IF BIT 7
074B 1B                 DCX  D         ;OF TABLE IS SET, WHICH
074C BE                 CMP  M         ;IS THE JUMP ADDR. (HI)
074D DA6107             JC   EX5       ;C:YES, MATCHED
0750 23         EX2:    INX  H         ;NC:NO, FIND JUMP ADDR.
0751 BE                 CMP  M
0752 D25007             JNC  EX2
0755 23                 INX  H         ;BUMP TO NEXT TAB. ITEM
0756 D1                 POP  D         ;RESTORE STRING POINTER
0757 C33B07             JMP  EX0       ;TEST AGAINST NEXT ITEM

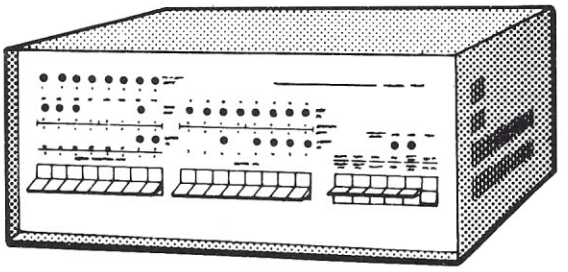
075A 3E7F       EX3:    MVI  A,07FH    ;PARTIAL MATCH, FIND
075C 23         EX4:    INX  H         ;JUMP ADDR., WHICH IS
075D BE                 CMP  M         ;FLAGGED BY BIT 7
075E D25C07             JNC  EX4
0761 7E         EX5:    MOV  A,M       ;LOAD HL WITH THE JUMP
0762 23                 INX  H         ;ADDRESS FROM THE TABLE
0763 6E                 MOV  L,M
0764 E67F               ANI  7FH       ;MASK OFF BIT 7
0766 67                 MOV  H,A
0767 F1                 POP  PSW       ;CLEAN UP THE GARBAGE
0768 E9                 PCHL           ;AND WE GO DO IT
                ;
                LSTROM:
1000                    ORG  1000H     ;HERE ON MUST BE RAM
1000            OCSW:   DS   1         ;SWITCH FOR OUTPUT
1001            CURRNT: DS   2         ;POINTS TO CURRENT LINE
1003            STKGOS: DS   2         ;SAVES SP IN 'GOSUB'
1005            VARNXT: DS   2         ;TEMP STORAGE
1007            STKINP: DS   2         ;SAVES SP IN 'INPUT'
1009            LOPVAR: DS   2         ;'FOR' LOOP SAVE AREA
100B            LOPINC: DS   2         ;INCREMENT
100D            LOPLMT: DS   2         ;LIMIT
100F            LOPLN:  DS   2         ;LINE NUMBER
1011            LOPPT:  DS   2         ;TEXT POINTER
1013            RANPNT: DS   2         ;RANDOM NUMBER POINTER
1015            TXTUNF: DS   2         ;->UNFILLED TEXT AREA
1017            TXTBGN: DS   2         ;TEXT SAVE AREA BEGINS
1366                    ORG  1366H
1366            TXTEND: DS   0         ;TEXT SAVE AREA ENDS
1366            VARBGN: DS   55        ;VARIABLE @(0)
139D            BUFFER: DS   64        ;INPUT BUFFER
13DD            BUFEND: DS   1         ;BUFFER ENDS
13DE            STKLMT: DS   1         ;TOP LIMIT FOR STACK
1400                    ORG  1400H
1400            STACK:  DS   0         ;STACK STARTS HERE
                ;
000D            CR      EQU  0DH
000A            LF      EQU  0AH
0000                    END
```

ABS	0450	AHOW	00A0	ASORR	04F4	AWHAT	04C7
BUFEN	13DD	BUFFE	139D	CHQSG	0486	CHKIO	0684
CHKSG	0483	CI1	069D	CK1	049E	CKHLD	0498
CR	000D	CRLF	000E	CURRN	1001	DEFLT	031D
DIREC	0738	DIVID	0466	DV1	0471	DV2	0473
DWA	BF78	ENDCH	04C2	ERROR	04CA	EX0	073B
EX1	073D	EX2	0750	EX3	075A	EX4	075C
EX5	0761	EXEC	073B	EXPR1	032D	EXPR2	0371
EXPR3	03A5	EXPR4	0405	FI1	04BA	FI2	04C1
FIN	04B2	FL1	0540	FL2	0555	FNDLN	0538
FNDLP	0540	FNDNX	0554	FNDSK	0556	FOR	01F8
FR1	0208	FR2	0212	FR3	0216	FR4	0219
FR5	021C	FR7	0231	FR8	0252	GETLN	04FA
GL1	04FE	GL2	0523	GL4	0530	GOSUB	01BF
GOTO	0160	HOW	00A6	IFF	02B4	INIT	0642
INPER	02C3	INPUT	02CD	IP1	02CD	IP2	02DB
IP3	02EB	IP4	0315	IP5	031C	LET	0323
LF	000A	LIST	016F	LOPIN	100B	LOPLM	100D
LOPLN	100F	LOPPT	1011	LOPVA	1009	LS1	0178
LSTRO	0769	LT1	032C	MD1	05F6	MSG1	06A3
MVDOW	05EE	MVUP	05E5	NEW	0132	NEXT	0257
NX0	025E	NX1	0298	NX2	02AC	NX3	0276
NX4	0288	NX5	02AA	OC2	066C	OC3	0671
OCSW	1000	OK	00AB	PARN	041A	PATLO	064F
PN1	059D	PN2	05A4	PN3	05B4	PN4	05B5
PN5	05C1	PN6	05C7	POPA	05FD	PP1	0617
PR0	019B	PR1	01A3	PR2	0192	PR3	01A9
PR6	01B2	PR8	01B6	PRINT	0187	PRTLN	05D2
PRTNU	0592	PRTST	0560	PS1	0561	PU1	063F
PUSHA	0619	QHOW	009F	QSORR	04F2	QT1	0571
QT2	057A	QT3	057E	QT4	0586	QT5	0591
QTSTG	056C	QWHAT	04C6	RR1	0440	RRNPN	1013
REM	02B0	RETUR	01DF	RND	0425	RSTAR	00BA
RUN	0141	RUNNX	0147	RUNSM	0157	RUNTS	0150
SETVA	04A0	SIZE	0459	SORRY	00B4	SS1	0028
ST1	00BD	ST2	00CD	ST3	00D6	ST4	0108
STACK	1400	START	0000	STKQO	1003	STKIN	1007
STKLM	13DE	STOP	013B	SUBDE	047C	SV1	04B0
TAB1	06AE	TAB2	06BE	TAB4	0702	TAB5	0714
TAB6	071A	TAB8	0722	TC1	0068	TC2	0073
TN1	007C	TSTNU	0077	TV1	0058	TXTBG	1017
TXTEN	1366	TXTUN	1015	VARBG	1366	VARNX	1005
WHAT	00AE	XP11	0333	XP12	0339	XP13	033F
XP14	0346	XP15	034E	XP16	0354	XP17	035A
XP18	035C	XP21	037A	XP22	037D	XP23	0380
XP24	0387	XP25	0398	XP26	039B	XP31	03A8
XP32	03C5	XP33	03CD	XP34	03D8	XP35	03F7
XP40	040B	XP41	0414	XP42	0421	XP43	0422

Merry Christmas

Happy New Year

MORE BYTES FOR YOUR BUCK!

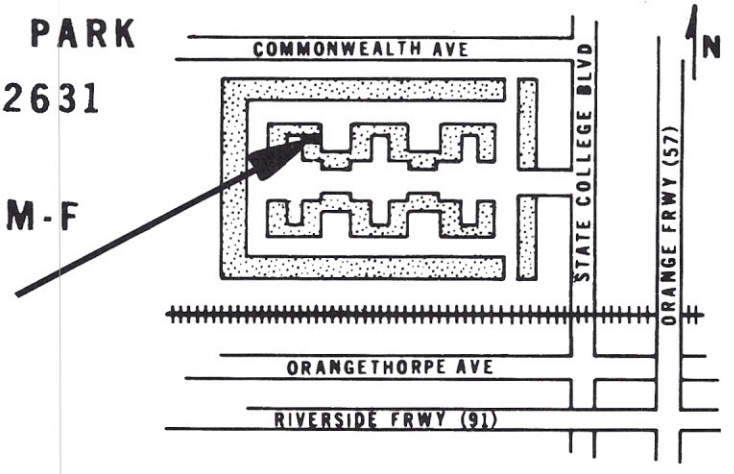


GET:

- **IMSAI**
- **Poly Morphic Systems**
- **Tarbell**
- **Solid State Music**
- **Pickles & Trout**
- **12" TV/Monitor $134.95**

BITS N BYTES

679 "D" S. STATE COLLEGE BLVD
COLLEGE BUSINESS PARK
FULLERTON, CA. 92631
(714) 879-8386
HOURS: 6-9 P.M. M-F
12-5 P.M. SAT.



CIRCLE INQUIRY NO. 62

PART 1 OF LLL 8080 BASIC INTERPRETER

By Jerry Barber & Royce Eckard

Submitted by E. R. Fisher
Lawrence Livermore Laboratory

FOREWARD

The BASIC interpreter was developed at the University of Idaho by John Dickenson, Jerry Barber, and John Teeter under a contract with the Lawrence Livermore Laboratory. The floating point package was developed by David Mead, modified by Hal Brand and Frank Olken. In addition, Jerry Barber, as an LLL summer employee, made significant contributions to this document and to implementing the BASIC language in an MCS-8080 microprocessor.

INTRODUCTION

This article is Part 1 of a series of four articles covering the LLL 8080 BASIC interpreter just released to the public domain by Lawrence Livermore Laboratory. The other three articles that will be published in the next three months are:

PART 2 — LLL 8080 BASIC INTERPRETER SOURCE PROGRAM WITHOUT FLOAT
PART 3 — LLL 8080 BASIC FLOAT SOURCE PROGRAM
PART 4 — LLL 8080 OCTAL DEBUGGING SOURCE PROGRAM

The partition approach of publishing the complete 120 page LLL BASIC interpreter source program assembly listing and descriptive text is taken as the only logical way to transfer the complete source program and text to INTERFACE AGE readers.

STORAGE REQUIREMENTS

The BASIC interpreter consists of a 5K-byte-PROM resident interpreter used for program generation and debug was configured to operate with the MCS-8080 microprocessor.

The goal in developing the 8080 BASIC was to provide a high-level, easy-to-use conversational language for performing both control and computation functions in the MCS-8080 microprocessor. To minimize system memory size and cost, the interpreter was constrained to fit into 5K bytes. It was necessary, therefore, to limit the commands to those considered the most useful in microprocessor applications.

MATH OPERATOR EXECUTION TIMES

Average execution times of the four basic math operators are as follows;

Operation	Execution time on 8080 (m sec)
ADD	2.4 m sec
SUBSTRACT	2.4 m sec
MULTIPLY	5.4 m sec
DIVIDE	7.0 m sec

BASIC INTERPRETER LANGUAGE GRAMMAR

COMMANDS — Six BASIC interpreter commands are provided. These commands are:

RUN	Begins program execution
SCR	Clears program from memory
LIST	Lists ASCII program in memory
PLST	Punches paper-tape copy of program
PTAPE	Reads paper-tape copy of program using high-speed reader
CNTRL S	Interrupts program during execution

The LIST and PLST commands can be followed by one or two line numbers to indicate that only a part of the program is to be listed. If one line number follows the command, the program is listed from that line number to the end of the program. If two line numbers (separated by a comma) follow the command, the listing begins at the first line number and ends at the second.

When a command is completed, READY will be typed on the teletype. Once initialized by a command, a process will normally go to completion. However, if you wish to interrupt an executing program or a listing, simply strike CNTRL S and the process will terminate and a READY message will be typed.

STATEMENTS — Each statement line begins with a line number, which must be an integer between 0 and 32767. Statements can be entered in any order, but they will be executed in numerical order. All blanks are ignored. The following types of statements are allowed:

REM — Indicates a remark (comment). The system deletes blanks from all character strings that are not enclosed in quotes ("). Therefore, it is suggested that characters following the REM key word be enclosed in quotes.

END — Indicates the end of a program. The program stops when it gets to the END statement. All programs must end with END.

Happy Holidays

DIODES

1N914	100v	10mA	.05
1N4004	400v	1A	.08
1N4005	600v	1A	.08
1N4007	1000v	1A	.15
1N4148	75v	10mA	.03
1N753A	6.2v	z	.25
1N758A	10v	z	.25
1N759A	12v	z	.25
1N4733	5.1v	z	.25
1N5243	13v	z	.25
1N5244B	14v	z	.25
1N5245B	15v	z	.25

SOCKETS/PLUGS

8-pin	pcb	.25	ww	.45
14-pin	pcb	.25	ww	.40
16-pin	pcb	.25	ww	.40
18-pin	pcb	.25	ww	.75
22-pin	pcb	.45	ww	.75
24-pin	pcb	.55	ww	1.25
28-pin	pcb	.35	ww	1.45
40-pin	pcb	.50	ww	1.95

Molex pins .01 To-3 Sockets .25

2 Amp Bridge 100-prv 1.20

25 Amp Bridge 200-prv 2.50

TRANSISTORS, LEDS, etc.

2N2222	NPN	.10
2N2907	PNP	.15
2N3906	PNP	.10
2N3055	NPN 15A 60v	.50
LED Green, Red, Yellow		.15
D.L. 747 7 seg 5/8" high		1.95
HP 276 Com-cathode .3" high		1.00
XAN72 7 seg com-anode		1.50
FND 359 Red 7 seg com-cathode		1.00

C MOS

CD4000	.25
CD4001	.25
CD4002	.25
CD4007	.35
CD4009	.25
CD4010	.50
CD4011	.25
CD4012	.25
CD4013	.40
CD4014	1.10
CD4015	1.10
CD4016	.45
CD4017	1.10
CD4018	1.10
CD4019	.70
CD4020	.85
CD4023	.25
CD4024	.95
CD4025	.35
CD4026	1.95
CD4027	.75
CD4030	.45
CD4033	1.95
CD4040	1.35
CD4044	.95
CD4046	1.50
CD4049	.80
CD4050	.85
CD4066	1.35
CD4069	.30
CD4071	.35
CD4082	.45
75108A	.35
75110	.35
75491	.50
75492	.50

— T T L —

7400	.15	7451	.25	74156	1.15	74S00	.55
7401	.15	7453	.25	74157	.95	74S02	.55
7402	.20	7454	.25	74161	1.25	74S03	.50
7403	.25	7460	.25	74163	1.25	74S10	.25
7404	.15	7470	.45	74164	.95	74S11	.45
7405	.25	7472	.45	74165	1.50	74S20	.50
7406	.45	7473	.35	74166	1.75	74S40	.30
7407	.55	7474	.40	74175	.95	74S51	.45
7408	.25	7475	.45	74176	1.25	74S64	.55
7409	.15	7476	.20	74180	.85	74S74	.50
7410	.15	7480	.65	74181	3.25	74S112	1.50
7411	.25	7483	1.00	74182	.95	74S133	.45
7412	.30	7485	1.05	74190	1.75	74S151A	1.00
7413	.65	7486	.40	74192	1.65	74S158	.65
7414	1.10	7489	2.75	74193	.85	74S194	1.50
7416	.25	7490	.40	74195	.95		
7417	.50	7491	1.15	74196	1.50	74LS00	.45
7420	.15	7492	.95	74197	1.25	74LS01	.45
7426	.40	7493	.60	74198	2.35	74LS02	.45
7427	.45	7494	1.25	74367	.85	74LS04	.55
7430	.20	7495	.85			74LS08	.45
7432	.45	7496	.95	74H00	.25	74LS09	.45
7437	.45	74100	1.85	74H04	.25	74LS10	.45
7438	.20	74107	.45	74H22	.40	74LS11	.45
7440	.25	74121	.40	74H52	.15	74LS20	.50
7441	1.15	74122	.55	74H53J	.25	74LS32	.55
7442	.65	74123	.55	74H72	.55	74LS40	.55
7443	.95	74125	.45	74H101	.75	74LS42	1.75
7444	.95	74132	1.35	74H103	.75	74LS74	.95
7445	.95	74141	1.30	74H106	.95	74LS90	1.30
7446	1.20	74150	1.00			74LS93	1.65
7447	1.20	74151	.95	74L00	.35	74LS107	1.50
7448	1.20	74153	.95	74L02	.35	74LS164	1.90
7450	.25	74154	.75	74L03	.45		
				74L10	.35		
				74L30	.45		

MEMORY, CLOCKS

74S188(8223)	3.00
8080	26.50
MM1702A	10.50
MM5314	3.95
MM5316	4.95
2102-1	1.95
2102L1	2.25
TMS6011	9.95
TR 1602A	6.95

LINEARS, REGULATORS, etc.

MCT2	.95	LM311	1.35	LM340T-15	1.65	LM723	.45
8038	3.95	LM320K5	1.65	LM340K-12	2.15	LM725	1.95
LM201AH	.75	LM320K12	1.65	LM340K-15	2.15	LM739	1.50
LM301AH	.55	LM320T12	1.65	LM340K-24	2.15	LM741	.25
LM308AH	1.00	LM320T15	1.65	LM373	1.95	LM747	1.10
LM309H	.65	LM339	1.65	LM380	1.55	LM1307	1.25
LM309K	.90	7805	1.00	LM709	.30	LM1458	.95
LM310	1.15	LM340T-12	1.65	LM711	.45	LM3900	.65
						LM75451	.65
						NE555	.50
						NE556	1.10
						NE565	1.15
						NE566	1.95
						NE567	1.35
						SN72720	.35
						SN72820	.35

INTEGRATED CIRCUITS UNLIMITED

7889 Clairemont Mesa Blvd. • San Diego, CA 92111 • (714) 278-4394

All orders shipped prepaid — No minimum

Open accounts invited — COD orders accepted

Discounts available at OEM Quantities

California Residents add 6% Sales Tax

24 Hour Phone (714) 278-4394 **MasterCharge / BankAmericard**

STOP — Stops the program. This statement is used when the program needs to be stopped other than at the end of the program text.

GOTO — Transfers program control to specified statement line number. This statement is used to loop or jump unconditionally within a program. Program execution continues from new statement.

DIM — Declares an array. Only one-dimensional arrays with an integer constant number of elements are allowed. An array with N elements uses indexes 0 through N-1. All array locations are set to zero. No check is made on subscripts to ensure that they are within the declared array. An array variable must be a single letter.

LET — Indicates an assignment statement (Addition, subtraction, multiplication, division, or special function may be used). The LET statement is used to assign a value to a variable. Non-array variables can be either a single letter or a letter followed by a digit. It is possible to have an array and a non-array variable with the same name. The general form of the LET statement is:

line number LET identifier = expression,

where "identifier" is either a subscripted array element or a non-array variable or function (see section on functions) and "expression" is a unary or binary expression. The expression will be one of the following ten types:

variable
−variable
variable + variable
variable − variable
−variable + variable
−variable − variable
variable * variable
−variable * variable
variable / variable,
−variable / variable,

where "variable" is an identifier, function, or number. The subscript of an array can also be an expression.

IF — Condition statement which transfers to specified line number statement if the condition of the expression is met. It has the form: line number IF expression relation expression THEN transfer line number. The possible relations are:

Equal	=
Greater than	>
Less than	<
Greater than or equal	>= =<
Less than or equal	<= =<
Not equal	<> ><

If the relation between the two expressions is true then the program transfers to the line number, otherwise it continues sequentially.

INPUT — This command allows numerical data to be input via the teletype. The general form is:

Line number INPUT identifier list,

where an "identifier list" is a sequence of identifiers separated by commas. There is no comma after the last identifier so, if only one identifier is present, no comma is needed. When an INPUT statement is executed, a colon (:) is output to the teletype to indicate that data are expected. The data are entered as numbers separated by commas. If fewer data are entered than expected, another colon is output to the teletype, indicating again that data are expected. For example, where

50 INPUT I,J,K,P

is executed, a colon is output to the teletype. Then, if only 3 numerical values are entered, another colon will be output to indicate that more data are expected; e.g.,

: 4,4,6.2 C/R
: 10.3 C/R,

where C/R is the carriage-return key. If an error is made in the input-data line, an error message is issued and the entire line of data must be re-entered. If, for the above example,

: 4,4,6M2,10.3 C/R

is entered, the system will respond

INPUT ERROR, TRY AGAIN
:

At this time, the proper response would be

4,4,6.2,10.3 C/R.

PRINT — This command allows numerical data and character strings to be printed on the teletype. Two types of print items are legal in the print statement: character strings enclosed in quotes (") and expressions. These items are separated by either a comma or a semicolon. If print items are separated by a comma, a skip occurs to the next pre-formatted field before printing of the item following the comma begins. The pre-formatted fields begin at columns 1, 14, 27, 40, and 52. If print items are separated by a semicolon, no skip occurs. If a semicolon or comma is the last character on a print statement line, the appropriate formatting occurs and the carriage-return-line feed is suppressed. A print statement of the form

50 PRINT

will generate a carriage-return-line feed. Thus, the two lines below

50 PRINT "INPUT A NUMBER";
60 INPUT A

will result in the following output:

INPUT A NUMBER:

FOR — Causes program to iterate through a loop a designated number of times.

NEXT — Signals end of loop at which point the computer adds the step value to the variable and checks to see if the variable is still less than the terminal value.

GOSUB — Transfer control to a subroutine that begins at specified line number

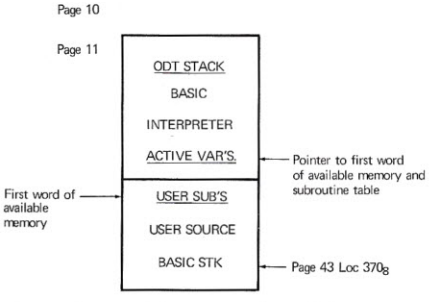
RETURN — Returns control to the next sequential line

after the last GOSUB statement executed. A return statement executed before a GOSUB is equivalent to a STOP statement.

CALL — Calls user-written assembly-language routines of the form

CALL (N, A, B, . . .),

where N is a subroutine number from 0 - 254 and A, B, . . . are parameters. The parameters can be constants, variables, or expressions. However, if variables and constants or expressions are intermixed, all variables should have been referenced before the CALL statement. Otherwise, the space reserved for newly referenced variables may overwrite the results of constants and expressions. A memory map of one configuration of the system is shown below:



The subroutine table contains 3-byte entries for each subroutine. The table directly follows the pointer to the first word of available memory (FWAM) and must end with an octal 377. A sample table and its subroutines is shown below:

```
      ORG 16612Q
      DW SUBEND        ; Define FWAM
      DB 1             ; Subroutine #1
      DW SUB1          ; Starting add of
                       subroutine #1
      DB 4             ; Subroutine #4
      DW SUB4          ; Starting add of
                       subroutine #4
      DB 5             ; Subroutine #5
      DW SUB5          ; Starting add of
                       subroutine #5
      DB 2             ; Subroutine #2
      DB SUB2          ; etc.
      DB 377Q          ; end of subroutine table
SUB1: ↓                ; Subroutine #1
      RET
SUB5: ↓                ; Subroutine #5
      RET
      •
      •
      •
      RET              ; Retain last subroutine
SUBEND EQU $           ; FWAM
```

Addresses to passed parameters are stored on the stack. The user must know how many parameters were passed to the subroutine. These must be taken off the stack before RET is executed. Addresses are stored last parameter first on the stack. Thus, on entry to a subroutine, the first POP instruction will recover the address to the last parameter in the call list. The next will recover the next to last, etc.

Each scalar variable passed results in the address to the first byte of a four-byte block of memory. Each array element passes the address to the first byte of a (N-M) x four-byte memory block, where N is the number of elements given the array in the DIM STMT and M is the array subscript in the CALL STMT.

For passed parameters to be handled in expressions within BASIC, they must be in the proper floating-point format.

FUNCTIONS — Two special functions not found in most BASIC codes are available to input or output data through Intel 8080 port numbers. These functions are;

GET (X) = READ 8080 INPUT PORT X.
PUT (Y) = OUTPUT A BYTE OF DATA TO OUTPUT PORT Y.

The function GET allows input from a port and the function PUT allows output to a port. Their general forms are:

GET (expression).
PUT (expression).

The function GET may appear in statements in a position that implies that a numerical value is used. The function PUT may appear in statements in a position that implies that a numerical value will be stored or saved. This is because GET inputs a number and PUT outputs a number. For example, while

LET PUT(I) =GET(J) is valid
LET GET(I) =PUT(J) is invalid.

These functions send or receive one byte of data, which in BASIC is treated as a number from 0 to 255.

VARIABLES — Single characters A → Z
Single character followed by a signal decimal digit

NUMBERS — Numbers in a program statement or input via the teletype are handled with a floating-point package provided by LLL. Numbers can have any of the following forms:

4	±4.	.123
4.	±4.0	±.123
4.0	1.23	0.123
±4	±1.23	±0.123

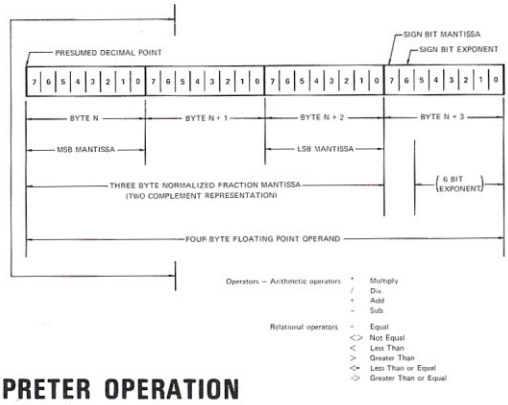
and the user may add an exponent to any of the above forms using the letter E to indicate powers of 10. The forms of the exponent are:

E±1	E±15
E 1	E 15
E 1	E 15

The numbers are stored with seven-digit accuracy; therefore, seven significant figures can be entered. The smallest and largest numbers are ±2.71051E-20 and ±9.22337E18.

Floating point numbers are expressed as a 32 bit operand consisting of a 24 bit normalized fractional mantissa in standard two's complement representa-

tion and a 6 bit exponent also in standard two's complement representation with a range of −64 to +63. The exponent byte also includes the exponent sign bit and mantissa sign bit. The floating point number format is as shown in the following:



INTERPRETER OPERATION

INITIALIZATION — the BASIC interpreter is presently configured so that it is located in memory pages 118 to 348. The starting address is page 178, location 0. This address begins an initialization sequence that allows the user to begin with a clear memory. However, to avoid the initialization sequence, a second starting address — page 178 to 348 — can be used. This starting address is used if the user wishes to retain any program that might exist in memory.

Once started the interpreter responds with READY.

INPUT LINE FORMAT

Each line entered is terminated with the carriage-return key. The line-feed key is ignored. Carriage-return automatically step terminal to next line and waits for next line statement number input. Statements can be entered in any order, but they will be executed in numerical order. All blanks outside of quotation marks are ignored by the interpreter. Up to 72 characters may be entered/line.

INPUT LINE EDITORING — A program can be edited by using the line numbers to insert or delete statements. Typing a line number and then typing a carriage return causes the statement at that line number to be deleted. Since the statements can be entered in any order, a statement can be inserted between two existing statements by giving it a line number between the two existing statement line numbers. To replace a statement, the new statement should have the same line number as the old statement.

It is possible to correct errors on a line being entered by either deleting the entire line or by deleting one or more characters on the line. A character is deleted with either the rubout key or the shift/0 key. Several characters can be deleted by using the rubout key several times in succession. Character deletion is, in effect, a logical backspace. To delete the line you are currently typing, use the CNTRL/Y key.

BASIC PROGRAM EXECUTION — Entering a RUN command, after a BASIC program has been entered into the microcomputer, will cause the current program to begin execution at the first statement number. RUN always begins at the lowest statement number.

ERROR MESSAGES — If an unrecognizable command is entered, the word WHAT? is printed on the teletype. Simply retype the command. It may also have been caused by a missing line number on a BASIC statement, in which case you should retype the statement with a line number.

During program execution and whenever new lines are added to the program, a test is made to see if there is sufficient memory. If the memory is full, MEMORY FULL is printed on the teletype. At this point, you should enter one of the single digits below to indicate what you wish to do:

Number entered	Meaning
0	(RUN) runs
0	(RUN) runs the program in memory
1	(PLST) outputs program in memory to paper tape punch
2	(LIST) lists program in memory
3	(SCR) erases program in memory
4	none of the above (will case WHAT? to be printed out on the tl out on the teletype).

To help you select the best alternative, a brief description of how the statements are manipulated in memory will be helpful. All lines entered as program are stored in memory. If lines are deleted or replaced, the originals still remain in memory. Thus, it is possible, if a great deal of line editing has been done, to have a significant portion of memory taken up with unused statements. If a MEMORY FULL message is obtained in these circumstances, then the best thing to do is punch a tape of the program (entering number 1), then erase the program memory with a SCR command (or a number 3, if memory is too full to accept commands), and then re-enter your program using the high-speed paper-tape reader with the PTAPE command.

If an error is encountered while executing a program, an error message is typed out that indicates an error number and the line number in which the error occurred. These numbered error messages are as follows;

ERROR NUMBER
ERROR MESSAGE

1 Program has no END statement
2 Unrecognizable keyword at beginning of statement
3 Source statements exist after END statement
4 Designation line number is improperly formed in a GOTO, GOSUB, or IF statement
5 Designation line number in a GOTO, GOSUB, or IF statement does not exist
6 Unexpected character
7 Unfinished statement
8 Illegally formed expression
9 Error in floating-point conversion
10 Illegal use of a function
11 Duplicate array definition
12 An array is referenced before it is defined
13 Error in the floating-point-to-integer routine, Number is too big
14 Invalid relation in an IF statement

LLL 8080 BASIC INTERPRETER PROGRAMS EXAMPLES

PRINT STATEMENT PROGRAM EXAMPLE — The program below gives a few examples of the use of the print statement.

```
LIST
1PRINT"THE PRE-FORMATTED COLUMNS ARE SHOWN BELOW"
2PRINT1,2,3,4,5
4PRINT
1ØPRINT"INPUT 1ST NUMBER";
2ØINPUTA
3ØPRINT"INPUT 2ND NUMBER",
4ØINPUTB
5ØPRINT
6ØPRINT"A IS";A
7ØPRINT"B IS",B
8ØPRINT"A IS";A;"B IS",B,"A+B IS";A+B
1ØØEND
READY
RUN
THE PRE-FORMATTED COLUMNS ARE SHOWN BELOW
1.ØØØØE ØØ    2.ØØØØE ØØ    3.ØØØØE ØØ    4.ØØØØE ØØ    5.ØØØØE ØØ

INPUT 1ST NUMBER:2
INPUT 2ND NUMBER          :3

A IS 2.ØØØØE ØØ
B IS          3.ØØØØE ØØ
A IS 2.ØØØØE ØØB IS         3.ØØØØE ØØ    A+B IS 5.ØØØØE ØØ
READY
```

PLOT FUNCTION PROGRAM — The following program plots a function on a display. It uses four user-written assembly-language subroutines. The display works as follows: The contents of memory locations on pages 2748 to 2778 are displayed as 16 rows of 64 characters each. Thus, if location 2018 on page 274 contains 3018 (ASCII A), an A appears in column 2 of Row 3. An example of this program's execution is shown below:

RUN
WHAT SHOULD PLOT BE LABELED? MCS80 — BASIC INTERPRETER
READY

The BASIC and assembly-language programs and the display output are shown below.

BASIC PROGRAM

Display output for Plot Function program.

BASIC Program

```
LIST
1REM"   THIS ROUTINE WILL PLOT A SET OF AXIS AND A QUADRATIC FUNCTION
2REM"   ON A DISPLAY AND THEN LABEL IT.  IT USES A 4 USER WRITTEN
3REM"   SUB-ROUTINES:
4REM
5REM"   CALL (1,X,Y,C) - PLACES C IN COLUMN X, ROW Y OF THE DISPLAY
6REM"     WHERE C IS AN ASCII CODED CHARACTER
7REM
8REM"   CALL(2,A(Ø)) - READS A CHARACTER STRING FROM THE TTY AND STORES
9REM"     IT"IN ARRAY A
10REM
11REM"  CALL(3,A(Ø)) - WRITES THE CHARACTER STRING STORED IN ARRAY A
12REM"    TO THE DISPLAY
13REM
14REM"  CALL(4) - CLEARS THE DISPLAY
15REM
16REM"    START OF PROGRAM
17REM
18REM"    RESERVE STORAGE AREA FOR TITLE
2ØDIMA(1Ø)
3ØREM"    CLEAR SCREEN
4ØCALL(4)
5ØREM"    ASK FOR AND INPUT TITLE
55PRINT"WHAT SHOULD PLOT BE LABELED?";
6ØCALL(2,A(Ø))
7ØREM"    DRAW AXIS
8ØGOSUB5ØØ
9ØREM"    PLOT FUNCTION
1ØØLETX=-29
11ØGOSUB1ØØØ
12ØCALL(1,31+X,8-Y,248)
13ØLETX=X+1
14ØIFX><31 THEN11Ø
15ØREM"   OUTPUT TITLE
16ØCALL(3,A(Ø))
165REM"   WE'RE DONE
17ØSTOP
5ØØREM"   THIS SUB. WILL DRAW A SET OF AXIS
5Ø5LETX=1
51ØLETY=7
52ØLETC=173
53ØCALL(1,X,Y,C)
54ØLETX=X+1
55ØIFX><65THEN53Ø
56ØLETX=31
57ØLETY=1
575LETC=252
58ØCALL(1,X,Y,C)
59ØLETY=Y+1
6ØØIFY><17THEN58Ø
61ØRETURN
1ØØØREM"  GIVEN X THIS SUB. CALCULATES (17/9ØØ)*X**2-8
1ØØ5REM"  FIRST CHECK IF X=Ø AS IT WILL UPSET FLT. PNT. PACK.
1Ø1ØIFX=ØTHEN1Ø45
1Ø15REM"  WE'RE OK - CALCULATE FUNCTION
1Ø2ØLETY=X*X
1Ø25LETK=17/9ØØ
1Ø3ØLETY=Y*K
1Ø35LETY=Y-8
1Ø4ØRETURN
1Ø45LETY=-8
1Ø5ØRETURN
2ØØØEND
READY
```

Assembly-language program

```
                        ;DEFINE EXTERNALS
014012                  FIX     EQU     14012Q          ;FIX ROUTINE
013212                  COPDH   EQU     13212Q          ;COPY ROUTINE
016567                  FREG1   EQU     16567Q          ;FLOATING PNT  REGISTER
016614                          ORG     16614Q
016614  027 036                 DW      SBEND           ;FWAM
                        ;ENTRIES IN SUB TABLE
016616  001                     DB      1
016617  233 035                 DW      SCOPE
016621  002                     DB      2
016622  334 035                 DW      SUB2
016624  003                     DB      3
016625  364 035                 DW      SUb3
016627  004                     DB      4
016630  003 036                 DW      SUB4
016632  377                     DB      377Q            ;NO MORE ENTRYS
                        ;THE CALL TO THIS ROUTINE IS OF THE FORM
                        ;       CALL(1 X Y C)
                        ;THE VALUE OF C IS PLACED IN COLUMN X  LINE Y
                        ;OF THE DISPLAY
016633  321             SCOPE:  POP     D               ;ADDRESS OF CHARACTER
016634  041 167 035            LXI     H FREG1         ;COPY TO FREG1
016637  315 212 026            CALL    COPDH
016642  353                    XCHG                    ;ADDRESS TO DE
016643  315 012 030            CALL    FIX             ;FIX IT
016646  023                    INX     D               ;PNT TO 4TH BYTE
016647  023                    INX     D
016650  023                    INX     D
016651  032                    LDAX    D               ;GET CHARACTER
016652  107                    MOV     B A             ;SAVE IN B
016653  321                    POP     D               ;ROW ADD
016654  041 167 035            LXI     H FREG1         ;COPY TO FREG1
016657  315 212 026            CALL    COPDH
016662  353                    XCHG
016663  315 012 030            CALL    FIX             ;FIX IT
016666  023                    INX     D               ;GET BYTE 4 TO A
016667  023                    INX     D
016670  023                    INX     D
016671  032                    LDAX    D
016672  117                    MOV     C A             ;SAVE IN C
016673  321                    POP     D               ;GET COLUMN ADD
016674  041 167 035            LXI     H FREG1         ;COPY TO FREG1
016677  315 212 026            CALL    COPDH
016702  353                    XCHG
016703  315 012 030            CALL    FIX             ;FIX IT
016706  023                    INX     D               ;PNT TO 4TH BYTE
016707  023                    INX     D
016710  023                    INX     D
016711  032                    LDAX    D               ;GET IT TO A
016712  041 377 273            LXI     H 135777Q       ;CALCULATION OF ADDRESS
016715  021 100 000            LXI     D 100Ø
016720  015             LUP:    DCR     C
016721  312 330 035            JZ      ADINC
016724  031                    DAD     D
016725  303 320 035            JMP     LUP
016730  137             ADINC:  MOV     E A
016731  031                    DAD     D               ;ADD IN COLUMN LOC
016732  160                    MOV     M B             ;STORE CHARACTER
016733  311                    RET                     ;DONE
                        ;SUB2 READS A TITLE FROM TTY VIA ODT
000333                  READ    EQU     333Q            ;ODT ROUTINE
016734  341             SUB2:   POP     H               ;GET STORAGE AREA ADD
016735  345                     PUSH    H
016736  016 000                 MVI     C Ø             ;INIT CNTR
016740  043             LUP2:   INX     H               ;BUMP PNTR
016741  315 333 000            CALL    READ            ;READ A CHARACTER
016744  376 215                 CPI     215Q            ;CR?
016746  312 356 035            JZ      DUN2            ;YES - DONE
016751  014                    INR     C               ;INCR  CNT
016752  167                    MOV     M A             ;SAVE CHARACTER
016753  303 340 035            JMP     LUP2
016756  341             DUN2:   POP     H               ;STORE CNT
016757  161                    MOV     M C
016760  076 212                MVI     A 212Q          ;SEND A LF
016762  367                    RST     6
016763  311                    RET                     ;DONE
                        ;SUB3 WRITES TITLE TO DISPLAY
016764  341             SUB3:   POP     H               ;GET ADD
016765  021 341 277            LXI     D 137741Q       ;SCREEN ADD
016770  116                    MOV     C M             ;CNT
016771  043                    INX     H
016772  176             LUP3:   MOV     A M             ;SEND STRING
016773  022                    STAX    D
016774  043                    INX     H
016775  023                    INX     D
016776  015                    DCR     C
016777  302 372 035            JNZ     LUP3
017002  311                    RET                     ;DONE
                        ;SUB4 CLEARS SCREEN
017003  041 000 274 SUB4:     LXI     H 136000Q       ;SCREEN ADD
017006  076 240                MVI     A 240Q          ;SPACE
017010  026 000                MVI     D Ø             ;CNTR S
017012  016 004                MVI     C 4
017014  167             LUP4:   MOV     M A             ;CLEAR IT
017015  043                    INX     H
017016  025                    DCR     D
017017  302 014 036            JNZ     LUP4
017022  015                    DCR     C
017023  302 014 036            JNZ     LUP4
017026  311                    RET                     ;DONE
017027                  SBEND   EQU     $
                                END
NO PROGRAM ERRORS
```

SYMBOL TABLE

```
* Ø1

A       000067    ADINC  016730    B       000000    C       000001
COPDH   013212    D      000002    DUN2    016756    E       000003
FIX     014012    FREG1  016567    H       000004    L       000005
LUP     016720    LUP2   016740    LUP3    016772    LUP4    017014
M       000006    PSW    000006    READ    000333    SBEND   017027
SCOPE   016633    SP     000006    SUB2    016734    SUB3    016764
SUB4    017003
```

BRANCH TO PAGE 124

21L02-1 RAM

500 N. S.

8 for $12.95

82S129-256 x 4 PROM

BI-POLAR--FAST!

$2.50

8080A CPU CHIP

$19.95 By AMD

ZILOG

Z-80 CPU CHIP

$69.95

MM5204 4K EPROM

$7.95

S. D. SALES CO.
P. O. BOX 28810 -
DALLAS, TEXAS 75228

SEE TERMS ON OTHER PAGE!

S.D. SALES CO.

P.O. BOX 28810 - E
DALLAS, TEXAS 75228

Z–80 CPU CARD KIT FOR IMSAI/ALTAIR

$149. KIT

From the same people who brought you the $89.95 4K RAM kit. We were not the first to introduce an IMSAI/ALTAIR compatible Z–80 card, but we do feel that ours has the best design and quality at the lowest price.

The advanced features of the Z–80 such as an expanded set of 158 instructions, 8080A software compatibility, and operation from a single 5VDC supply, are all well known. What makes our card different is the extra care we took in the hardware design. The CPU card will always stop on an M1 state. We also generate TRUE SYNC on card, to insure that the rest of your system functions properly. Dynamic memory refresh and NMI are brought out for your use. Believe it or not, not all of our competitors have gone to the extra trouble of doing this.

As always, this kit includes all parts, all sockets, and complete instructions for ease of assembly. Because of our past experience with our 4K kit we suggest that you order early. All orders will be shipped on a strict first come basis. Dealers inquiries welcome on this item.

Kit shipped with 2 MHZ crystals for existing 500NS memory. Easily modified for faster RAM chips when the prices come down.

Z–80 Manual – $7.50 Separately.

Kit includes Zilog Manual and all parts.

JUMBO LED CAR CLOCK

$16.95 KIT

You requested it! Our first DC operated clock kit. Professionally engineered from scratch to be a DC operated clock. Not a makeshift kluge as sold by others. Features: Bowmar 4 digit .5 inch LED array, Mostek 50252 super clock chip, on board precision time base, 12 or 24 hour real time format, perfect for cars, boats, vans, etc. Kit contains PC Board and all other parts needed (except case). 50,000 satisfied clock kit customers cannot be wrong!

FOR ALARM OPTION ADD $1.50
FOR XFMR FOR AC OPERATION ADD $1.50

60 HZ CRYSTAL TIME BASE FOR DIGITAL CLOCKS
S.D. SALES EXCLUSIVE!

KIT FEATURES:

A. 60HZ output with accuracy comparable to a digital watch.
B. Directly interfaces with all MOS Clock Chips.
C. Super low power consumption. (1.5 ma typ.) **$5.95 or**
D. Uses latest MOS 17 stage divider IC. **2/$10.**
E. Eliminates forever the problem of AC line glitches.
F. Perfect for cars, boats, campers, or even for portable clocks at ham field days.
G. Small Size, can be used in existing enclosures.

KIT INCLUDES CRYSTAL, DIVIDER IC, PC BOARD PLUS ALL OTHER NECESSARY PARTS & SPECS

50HZ CRYSTAL TIME BASE KIT – $6.95

All the features of our 60HZ kit but has 50HZ output. For use with clock chips like the 50252 that require 50HZ to give 24 hour time format.

THIS MONTH'S SPECIALS!

SPECIAL *SPECIAL*

300.00 KHZ CRYSTAL – $1.50
8080A – CPU CHIP by AMD – $19.95
82S129 – 256 x 4 PROM – $2.50
N.S. 8865 OCTAL DARLINGTON DRIVERS
3 for $1.00
Z-80 – CPU by ZILOG – $69.95
MM5204 – 4K EPROM – $7.95

Prices in effect this month ONLY!

4K LOW POWER RAM BOARD KIT
THE WHOLE WORKS – $89.95

Imsai and Altair 8080 plug in compatible. Uses low power static 21L02–1 500ns. RAM's, which are included. Fully buffered, drastically reduced power consumption, on board regulated, all sockets and parts included. Premium quality plated thru PC Board.

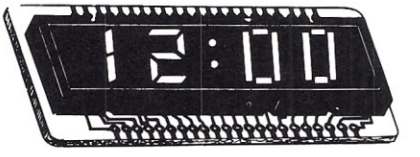
SIGNETICS ANALOG MANUAL – $5.95

Just out! From the acknowledged leader in linear technology. Theory, applications, and specs. on op amps, timers, phase locked loops, etc. 637 pages.

A MUST For Any Technical Library!

STICK IT! in your clock in your DVM, etc.!

$3.95



4 JUMBO .50" DIGITS ON ONE STICK! (with colons and AM/PM Indicator)

Huge Special Purchase Not Factory Seconds As sold by others!

BUY 3 for $10.

BOWMAR 4 DIGIT LED READOUT ARRAY

The Bowmar Opto-Stick. The best readout bargain we have ever offered. Has four common cathode jumbo digits with all segments and cathodes brought out. Increased versatility since any of the digits may be used independently to fit your applications. Perfect for any clock chip, especially direct drive units like 50380 or 7010. Also use in freq. counters, DVM's, etc. For 12 or 24 hour format.

UP YOUR COMPUTER!
21L02–1 1K LOW POWER 500 NS STATIC RAM
TIME IS OF THE ESSENCE!

And so is power. Not only are our RAM'S faster than a speeding bullet but they are now very low power. We are pleased to offer prime new 21L02–1 low power and super fast RAM's. Allows you to STRETCH your power supply farther and at the same time keep the wait light off. **8 for $12.95**

HOUSE NO. TTL

7400 – 8/$1.00	7420 – 8/$1.00	74141 – 3/$1.00
7404 – 8/$1.00	7437 – 5/$1.00	74153 – 3/$1.00
7408 – 8/$1.00		7438 – 5/$1.00

Please specify that you are ordering House No. TTL

WESTERN DIGITAL UART

No. TR1602B. 40 pin DIP
This is a very powerful and popular part.
NEW–$6.95 with data
LIMITED QUANTITY

RESISTOR ASSORTMENT

¼ W 5% and 10% PC leads. A good mix of values. 200/$2.

FAIRCHILD BIG LED READOUTS

A big .50 inch easy to read character. Now available in either common anode or common cathode. Take your pick. Super low current drain, only 5MA per segment typical.

FND 510 Common Anode
FND 503 Common Cathode
PRICE SLASHED! 59c each

SLIDE SWITCH ASSORTMENT

Our best seller. Includes miniature and standard sizes, single and multi-position units. All new, first quality, name brand. Try one package and you'll reorder more. **SPECIAL 12/$1.**

MOTOROLA POWER DARLINGTON
Back in Stock!

Like MJ3001. NPN 80V. 10A. HFE 6000 TYP. TO–3 case. We include a free 723C volt reg. with schematic for power supply. SPECIAL–$1.99

CALL YOUR BANK AMERICARD OR MASTER CHARGE ORDER IN ON OUR CONTINENTAL UNITED STATES TOLL FREE WATTS:

1–800–527-3460

Texas Residents Call Collect

214/271-0022

TERMS:

Money Back Guarantee. No COD. Texas Residents add 5% tax. Add 5% of order for postage and handling. Orders under $10. add 75c. Foreign orders: US Funds ONLY!

S.D. SALES CO.
P.O. BOX 28810 E
Dallas, Texas 75228

CIRCLE INQUIRY NO. 64

NIBL — National's Tiny Basic Language for SC/MP

By Phil Roybal, National Semiconductor

Since the birth of the first computing machines, users have sought simple ways to build the programs to drive them. While hardware technology advanced by leaps and bounds in the 50's and 60's, man-machine communication struggled painfully forward from patch panels to switch arrays and machine code programming. Finally the first crude assembler, child of a desperate engineer turned programmer, gave promise that users would someday "talk" with their machines in a mutually intelligible language.

Devices available today will allow a computer to identify spoken words and to respond vocally. But it will be a long time before the average hobbyist or industrial user will be able to describe a problem to his computer in common prose and expect any sort of intelligent response. The closest thing to this programmer's dream today is the high-level language: typically a simple, limited vocabulary of written English words in a rigidly defined grammer. The BASIC programming language is a typical example. The high-level language is usually implemented in a translation program (either compiler or interpreter) that analyzes each source code input statement and then expresses it as a series of machine language commands. High-level languages offer these advantages to their users:

- LEGIBILITY — High-level language statements are much easier to read and write than are their assembly language equivalents. This simplifies program construction, debug, and documentation.
- SPEED OF PROGRAMMING — Each statement expands into five to ten machine code commands; thus a high-level language programmer can write a program much more quickly than can an assembly language programmer who must generate the same amount of code.
- TRANSPORTABILITY — Programs written in a high-level language are (to some extent) machine independent. Thus code written for one processor can often be used on an entirely different processor with only minor modification.

Of course nothing comes for free, and the advantages of high-level languages have their price. Programs written in them can take 50% to 200% more memory for their operation; and they often execute much more slowly than equivalent assembly language programs. Until quite recently these drawbacks restricted the use of high-level languages to systems where frequent reprogramming was the rule, and some loss of performance was tolerable. They rarely appeared in production computer systems which had to be reproduced in quantity; and they weren't used with microprocessors, which were devoted almost exclusively to the control of such systems. But several things have happened over the last two years to change all that.

First, microprocessors, memories, and related hardware have become simple and inexpensive enough to appeal to the hobbyist, who tends to spend his time programming. He is not interested in production economies since he rarely builds more than one or two systems. But he is highly receptive to tools that make his programming chores easier and more fun.

Second, microprocessor technology has begun to penetrate non-traditional industries. In these new application areas potential users not only have not used programmed logic before, but some have never used electronic components, let alone microcomputers. They have built mechanical and fluid control systems, where the control algorithms were defined by levers and pipes. But they have little electronic experience, and no programming experience at all. They need programming tools that are easy to understand and to use; and they are willing to part with some system speed and economies to get them.

These forces have spurred the development of high-level languages for microprocessors. Thus, when National brought out SC/MP and aimed it at the low-end control market, hobbyists, and non-traditional users, some kind of high-level language seemed like a necessity. And when TINY BASIC a limited version of

the standard BASIC language began to gain wide acceptance among hobbyists as a game and control language for microprocessors began to look like a good all around language choice.

For a language to be really useful on microprocessors, it must be good for digital input/output and device control as well as for games and text manipulation. TINY BASIC, developed as a games language, needed improvement in the I/O area. So a series of extensions to the hobbyist standard TINY BASIC were defined and built. Thus was born National Industrial Basic Language: NIBL (pronounced "Nibble") for short. The objectives for the NIBL language were as follows:

- To be a vehicle for rapidly building and evaluating control algorithms.
- To be a simple "self-teaching" approach to the understanding of microprocessors.
- To make use of numerous TINY BASIC games and control programs already in the public domain.
- To be a tool for quickly programming low-volume, moderate-speed application systems.
- To be easily expandable by National and by the user.

TINY BASIC, as originally conceived and written, was an interpreter — a translator that executes source code statements directly, one at a time, without first translating the user's entire program into machine language as compilers do. This approach has the advantage of easier source code manipulation (because the source is always available), and instant feedback of simple grammatical errors. The interpretive approach was retained in NIBL.

Since the original TINY BASIC language was intended to be adapted for many microprocessors, it was itself written interpretively in an ideal language (IL), designed expressly for the construction of translators. Thus, to adapt the language for SC/MP, it was necessary only to construct a simple interpreter that allowed the IL to execute on SC/MP as dipicted in the NIBL symbolic concept (Figure 1). The generalized, already written TINY BASIC interpreter would then be usable on SC/MP. This multi-layered, onion-like approach gains two things: the IL interpreter for the NIBL interpreter is smaller and simpler to write than an interpreter for all of NIBL, so the initial investment to produce the product is reduced. Secondly, since most of NIBL is programmed in a highly efficient instruction set especially tailored for writing translators, the interpreted NIBL is smaller than direct coding would allow. Thus we trade off execution speed for memory efficiency. Though all this sounds complex in the telling, it is invisible to the user, so it doesn't matter to most people.

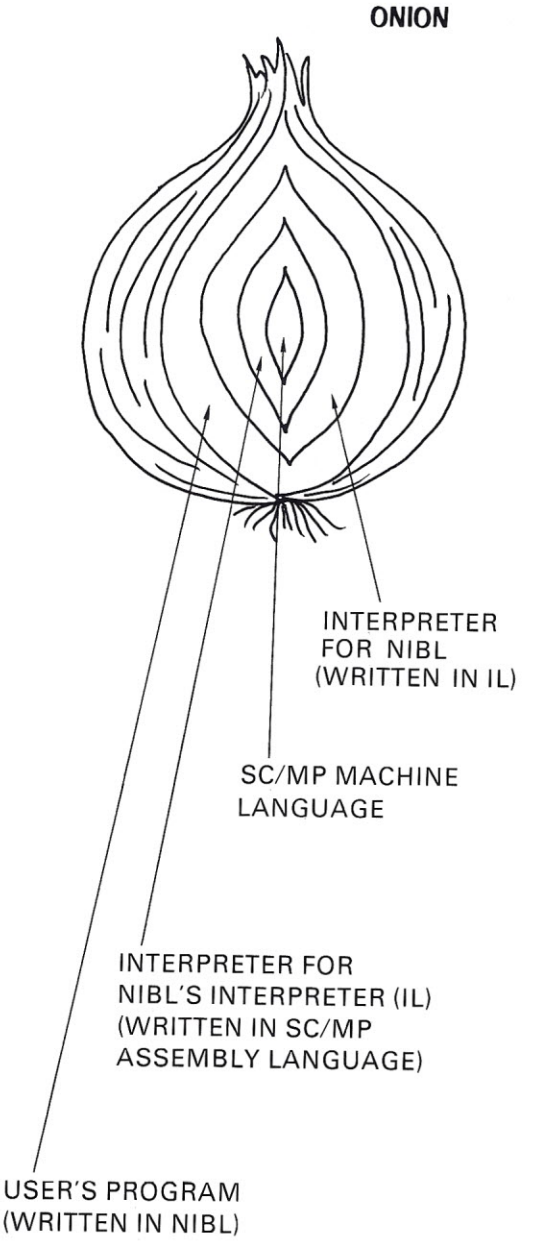


FIGURE 1. THE NIBL CONCEPT

NIBL, an interpreter, is written in an ideal language (IL), which is itself interpreted by a program written in SC/MP assembly language.

(Diagram by permission of Dr. Dobb's Journal — Reference 1)

NIBL LANGUAGE

Language conventions and operating information are shown in the following NIBL Quick Reference Guide. This is a summary of the legal commands and statements of NIBL.

INPUT LINE FORMAT AND EDITING

- Lines without numbers executed immediately.

- Lines with numbers inserted (in sequence) in program.
- Line number alone (empty line) deletes line.
- Blanks are meaningless, but key words must not contain blanks.
- CONTROL/U deletes current line.
- CONTROL/C aborts program, returns to command mode.
- "←" deletes last character typed.
- CARRIAGE RETURN terminates a line.

COMMANDS

CLEAR deletes all program information
RUN runs program
LIST lists program
LIST X lists program from line X on
GOTO X runs program from line X on
PAGE = X selects 4K byte user page X
NEW clears program but not variable assignments from the selected page.

STATEMENTS

INPUT/OUTPUT STATEMENTS

```
PRINT X,Y,Z
PRINT "THE ANSWER IS," X
INPUT X,Y,Z
aL = 1
J = aL
```

ASSIGNMENT STATEMENTS

```
LET X = 3
LET X = −15 + 5 * Y
```

CONTROL STATEMENTS

```
GOTO X + 10
GOTO 10
GOSUB Y + 15
RETURN
IF X = Y THEN GOTO 15
DO: A = A + 1: PRINT A: UNTIL A = 10
FOR B = 2 TO 20 STEP 2
....
....        NEXT B
....
REM THIS IS A COMMENT LINE
END Ends a program
LINK 5000
```

VARIABLES

A Z (26 only)

CONSTANTS

NUMBERS

Decimal 0 9
HEX 0 F
All arithmetic is modulo 2^{15} (±32768)

Merry Christmas

OPERATORS

Arithmetic	Relational	Logical
+ −	> >=	OR
* /	< <=	AND
	= <>	NOT

NIBL GRAMMAR

As originally defined, TINY BASIC had the grammatical elements indicated by the asterisk sign (*) in the text margin. While this grammar is adequate for a variety of games and internal data manipulations, it can be improved considerably for control applications through the addition of the rest of the elements shown in the following.

```
NIBL LINE = IMMEDIATE STATMENT
          ! PROGRAM LINE
          ! INPUT RESPONSE ;

IMMEDIATE STATEMENT =
(COMMAND ! STATEMENT) CARRIAGE RETURN ;
PROGRAM LINE = (DECIMAL NUMBER
        STATEMENT LIST CARRIAGE RETURN) ;
INPUT RESPONSE = REL EXP (',' REL EXP) *
                          CARRIAGE RETURN ;

  COMMAND = 'NEW'
*   ! 'CLEAR'
*   ! 'LIST' DECIMAL NUMBER?
*   ! 'RUN'
    ! 'PAGE'
    ;

  STATEMENT LIST = STATEMENT
              (':' STATEMENT) * ;

* STATEMENT = 'LET' ? (VARIABLE ! 'STAT' ! 'à'
                  FACTOR) '=' REL EXP
*   ! 'GO' ('TO' ! 'SUB') REL EXP
*   ! 'RETURN'
*   ! ('PR' ! 'PRINT') PRINTLIST
*   ! 'IF' REL EXPR 'THEN' ? STATEMENT
*   ! 'DO'
    ! 'UNTIL' REL EXP
    ! ' FOR' VARIABLE '=' REL EXP 'TO' REL EXP
                          ('STEP' REL EXP) ?
    ! 'NEXT' VARIABLE
*   ! 'INPUT' VARIABLE +
    ! 'LINK' REL EXP
    ! 'REM' ANY CHARACTER EXCEPT CARRIAGE
                  RETURN
*   ! 'END'
    ;

  REL EXPR=EXPRESSION RELOP EXPRESSION
    ! EXPRESSION
    ;

*   RELOP =  '<'
*   ! '<' '='
*   ! '<' '>'
*   ! '>'
*   ! '>' '='
*   ! '='
    ;
```

Happy New Year

```
    EXPRESSION=EXPRESSION ADDING
                OPERATOR TERM
    ;
* ADDING OPERATOR = '+' ! '-'
    ! 'OR' ;
  TERM = TERM MULTIPLYING OPERATOR FAC-
         TOR
    ! FACTOR
    ;
*  MULTIPLYING OPERATOR= '*' ! '/'
    ! 'AND' ;
*   FACTOR = VARIABLE
*   ! DECIMAL NUMBER
*   ! '<' REL EXPR '>'
    ! 'à' FACTOR
    ! '#' HEX NUMBER
    ! 'NOT' FACTOR
    ! 'RND' '<' REL EXP ',' REL EXP '>'
    ! 'STAT'
    ! 'TOP'
    ;
* VARIABLE = 'A' ! 'B' ! 'C' ! . . . ! 'Y' ! 'Z' ;
* DECIMAL NUMBER = DECIMAL DIGIT + ;
* DECIMAL DIGIT = '0' ! '1' ! '2' ! . . . ! '9' ;
  HEX NUMBER = ( DECIMAL DIGIT ! HEX DIGIT )
               +
  HEX DIGIT = 'A' ! 'B' ! 'C' ! 'D' ! 'E' ! 'F' ;
```

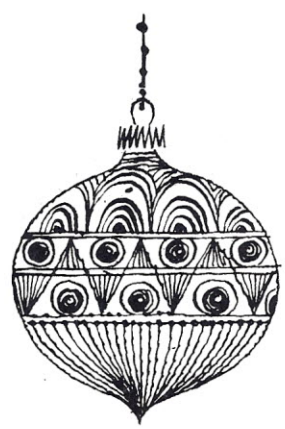
```
  PRINTLIST = (STRING ! REL EXPR) (STRING !
              REL EXPR)) * ';' ? ;
  STRING = ''' ALMOST ANY CHARACTER '''
```

NOTE: ALL ITEMS IN SINGLE QUOTES ARE ACTUAL SYMBOLS IN NIBL; ALL OTHER IDENTIFIERS ARE SYMBOLS IN THE GRAMMAR. THE EQUALS SIGN (=) MEANS ''IS DEFINED AS''; PARENTHESES ARE USED TO GROUP SEVERAL ITEMS TOGETHER AS ONE ITEM; THE EXCLAMATION POINT (!) MEANS AN EXCLUSIVE-OR CHOICE BETWEEN THE ITEMS ON EITHER SIDE OF IT; THE ASTERISK (*) MEANS ZERO OR MORE OCCURRENCES OF THE ITEM TO ITS LEFT; THE PLUS SIGN (+) MEANS ONE OR MORE REPETITIONS; THE QUESTION MARK (?) MEANS ZERO OR ONE OCCURRENCES; AND THE SEMICOLON (;) MARKS THE END OF A DEFINITION.

IN NIBL, SPACES ARE NOT SIGNIFICANT EXCEPT WITHIN THE SYMBOLS IN SINGLE QUOTES IN THE GRAMMAR ABOVE. NUMBERS AND RESERVED WORDS LIKE 'PRINT' OR 'GO' MUST NOT HAVE SPACES WITHIN THEM. A VARIABLE MUST BE FOLLOWED IMMEDIATELY BY A NON-ALPHABETIC CHARACTER IN ORDER TO DISTINGUISH IT FROM A KEY WORD.

NOTE: The guidelines, grammar, TINY BASIC source code (in IL) and the IL definitions were lifted directly from Dr. Dobbs' Journal (see bibliography).

Happy Holidays



Seasons Greetings

P.O. Box 4430N Santa Clara, CA 95054
(408) 988-1640

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

Quest ELECTRONICS

INTEGRATED CIRCUITS

7400TTL

SN7400N	.17	SN74LS74N	.59
SN7402N	.17	SN74LS75N	.75
SN7404N	.19	SN74LS93N	1.10
SN7410N	.17	SN74LS95N	1.89
SN7414N	.63	SN74LS107N	.52
SN7420N	.17	SN74LS163N	2.05
SN7430N	.20	SN74LS258N	2.20
SN7440N	.17	**LINEAR**	
SN7447N	.60	CA3082	1.90
SN7450N	.17	CA3089	2.75
SN7473N	.36	LM301AN	.35
SN7474N	.32	LM301AH	.35
SN7475N	.49	LM307N	.35
SN7489N	2.00	LM308N	.89
SN7490N	.45	LM309K	.95
SN7492N	.45	LM320K-5	1.35
SN7493N	.49	LM323K-5	6.95
SN74107N	.90	LM302K-12	1.35
SN74121N	.39	LM320K-15	1.35
SN74145N	.89	LM320T-5	1.60
SN74150N	.95	LM320T-8	1.60
SN74151N	.75	LM320T-12	1.60
SN74154N	1.10	LM320T-15	1.60
SN74157N	.95	LM324N	1.10
SN74174N	1.19	LM339N	1.55
SN74175N	.90	LM340K-5	1.60
SN74193N	.85	LM340T-5	1.50
SN74285N	6.00	LM340T-8	1.70
SN74298N	1.65	LM340T-12	1.70
74LS00 TTL		LM340T-15	1.70
SN74LS00N	.34	LM380N	1.00
SN74LS02N	.34	LM703H	.40
SN74LS04N	.39	LM709H	.28
SN74LS08N	.39	LM723N	.44
SN74LS10N	.39	LM733N	.89
SN74LS20N	.34	LM741CH	.35
SN74LS28N	.41	LM741N	.25
SN74LS30N	.34	LM1303N	.82
SN74LS38N	.39	LM2902	1.50
		LM3900N	.55

LM3909N	.89	CD4042	1.50
MC1458V	.59	CD4043	2.00
NE540L	3.90	CD4044	2.00
NE550N	.65	CD4049	.62
NE555V	.43	CD4050	.62
NE556A	1.00	CD4066	1.20
NE565A	1.00	CD4068	.25
NE566V	1.85	CD4069	.40
NE567V	1.25	CD4071	.40
SN75451CN	.39	CD4072	.40
SN75452CN	.39	CD4073	.40
SN75491CN	.50	CD4075	.40
SN75492CN	.55	CD4078	.40
SN75494CN	.89	CD4081	.40
A to D CONVERTER		CD4082	.45
8700CN	16.00	CD4508	5.00
CMOS		CD4510	2.00
CD34001 Fair.	.42	CD4511	2.20
CD4001	.25	CD4515	4.00
CD4002	.25	CD4520	2.90
CD4006	1.80	CD4527	4.75
CD4007	.25	CD4528	1.50
CD4008	2.30	CD4583	4.50
CD4010	.53	CD4585	2.45
CD4011	.25	CD40192	3.00
CD4012	.25	74C00	.28
CD4013	.40	74C04	.33
CD4014	2.00	74C10	.28
CD4015	2.00	74C14	2.10
CD4016	.50	74C20	.28
CD4017	1.00	74C30	.28
CD4020	1.35	74C48	2.95
CD4021	2.00	74C74	.75
CD4023	.25	74C106	2.10
CD4024	1.20	74C160	2.00
CD4025	.32	74C192	2.40
CD4026	3.85	74C221	2.75
CD4027	.55	74C905	3.00
CD4029	1.70	74C906	1.50
CD4030	.55	74C925	10.50
CD4040	2.25	74C927	12.00

INTERFACE	
8095	.75
8096	.75
8097	.75
8098	.75
8T09	1.25
8T10	4.50
8T20	6.95
8T23	3.10
8T24	3.50
8T25	3.20
8T26	2.75
8T97	2.45
8T98	2.45
MOS/MEMORY RAM	
2101-1	4.50
2102-1	2.20
2107B	8.00
2111-1	7.00
2112-2	7.90
2513B	10.00
21L02-1	2.50
MM5056	2.20
MM5060	3.20
MM5262	.90
MM5330	9.75
CLOCKS	
MM5309	4.00
MM5311	3.60
MM5312	4.80
MM5313	3.60
MM5314	3.90
MM5315	4.00
MM5316	6.35
MM5318	6.85
MM5369	3.00
MM5371N	5.50
MM5841	10.50
CT7001	5.80

MM5375AA/N	4.00
MM5375AB/N	4.90
MA1002A, C, or E Complete clock module minus xfmr and switches	$9.95
4 digit, 7 function stopwatch/timer circuit, new National MM5865 $9.00 Board available. 10 page spec only, $1.00	
IC SOCKETS	
Solder Tin Low Profile	
PIN 1UP PIN 1UP	
8 .15 24 .36	
14 .18 28 .43	
16 .20 36 .58	
18 .27 40 .61	
22 .35	
MICROPROCESSOR	
8080 with data	24.50
8080A with data	33.50
8224	11.50
8212	5.25
8228	11.50
SPECIAL PRODUCTS	
LM1812N Ultrasonic Transceiver	7.50
LM3909N LED Flasher/ Oscillator	.89
LM379S Dual 6W Audio Amplifier	5.00

DS0026CN 5 MHz Dual MOS Clock Driver	3.75
Calculator Module	2.95
Encoder HD0165-5	7.50
UART/FIFO AY5-1013	6.20
3341	8.50
PROM 1702A	11.50
N82S23	3.25
N82S123	4.00
N82S126	4.85
RESISTORS ¼ w 5% in quantities of 25 per type. .03 ea.	
MISCELLANEOUS 12 Volt 300 ma transformer	1.25
Keyer 8043	14.50
LEDS Red T018	.15
Green T018	.20
Orange T018	.20
Yellow T018	.20
Jumbo Red	.20
Jumbo Green	.25
Jumbo Yellow	.25
Jumbo Orange	.25

DISPLAY LEDS	
MAN1	CA .270 2.90
MAN3	CC .125 .39
MAN6640 Dual	CC .500 3.50
MAN72	CA .300 1.50
MAN74	CC .300 1.50
DL704	CC .300 1.50
DL707	CA .300 1.50
DL727	CA .500 2.55
DL747	CA .600 2.25
FND359	CC .357 .95
FND503	CC .500 1.35
FND510	CA .500 1.35
FND800	CC .800 2.75
FND807	CA .800 2.75
5 digit 14 pin display	2.50
NSN3M 3 digit 6 pin	.39
7520 Clairex photocells	.25
5082-7340 Hex	5.50
CRYSTALS	
1 MHz	4.50 6.5536 4.50
2 MHz	4.50 1.8432 4.50
4 MHz	4.25 2.097152 7.75
5 MHz	4.25 2.4576 7.50
10 MHz	4.25 3.2768 7.50
18 MHz	3.90 5.0688 4.50
20 MHz	3.90 5.185 4.50
32 MHz	3.90 5.7143 4.50
32768 Hz	4.00 18.432 4.50
	22.1184 4.50
NATIONAL SC/MP KIT Full instruction manual plus board and all components including RAM and ROM $99.00	
Data Access Arrangement Kit. Instr. Incl.	10.00

RV 12 V Alarm/Clock Kits Beautiful stainless finish, crystal accuracy. Excellent for wall mount on campers, boats.

RVC-4 clock Kit	$31.95
Fully assembled	36.95
RVC-6A alarm clock kit	$49.95
Fully assembled	54.95

8K Ram board Kit
- Plug compatible with Altair 8800 and Imsai 8080
- Low power 500 NS RAMS

All parts included with full instructions. $250.00

EPROM and I/O Board kits also available.

60 Hz Crystal Time Base Kit $5.95 Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy. Kit includes: PC board, MM5369, crystal, resistors, capacitors and trimmer.

Digital Temperature Meter Kit Indoor, outdoor −30° + 125°. .50" LED readout available Dec. Full Instructions $39.95

MODEM $79.50 Used Vadic modems in excellent condition, 103 type, 0 to 300 Baud. 202 type also available, 0 to 1200 Baud. $175.00

Mile Per Gallon Circuit

Digital Flow Sensor	$29.50
Speed Transducer (Specify car make and year)	8.00
CMOS Rate Multipliers	19.95
2−.50 in. Displays (orange or red)	2.50

Includes circuit description. PC Board not included.

Not a Cheap Clock $17.45 Includes everything except case.

2-PC boards. 6-.50 LED Displays. 5314 clock chip transformer, all components and full instructions.

Frequency Counter Kit Covers audio, ultrasonic and low amateur band to 5 MHz typical Dual channel high sensitivity ±25 millivolts. Crystal controlled clock. Can be prescaled for higher frequency. 6-.50" digits. Full instructions. Less power supply $40.00

COSMAC 'ELF'

RCA CMOS Microcomputer

CDP1802	$29.50	2101	4.50
CDP1824	9.00	5082-7340	5.50
CDP1852	10.25	Users Manual	7.50

Complete kit of additional parts minus power supply and board $40.00

TERMS: $5.00 min. order U.S. funds Calif. residents add 6% tax.

FREE: Send for your copy of our 1976 QUEST CATALOG. Include 13¢ stamp.

CIRCLE INQUIRY NO. 66

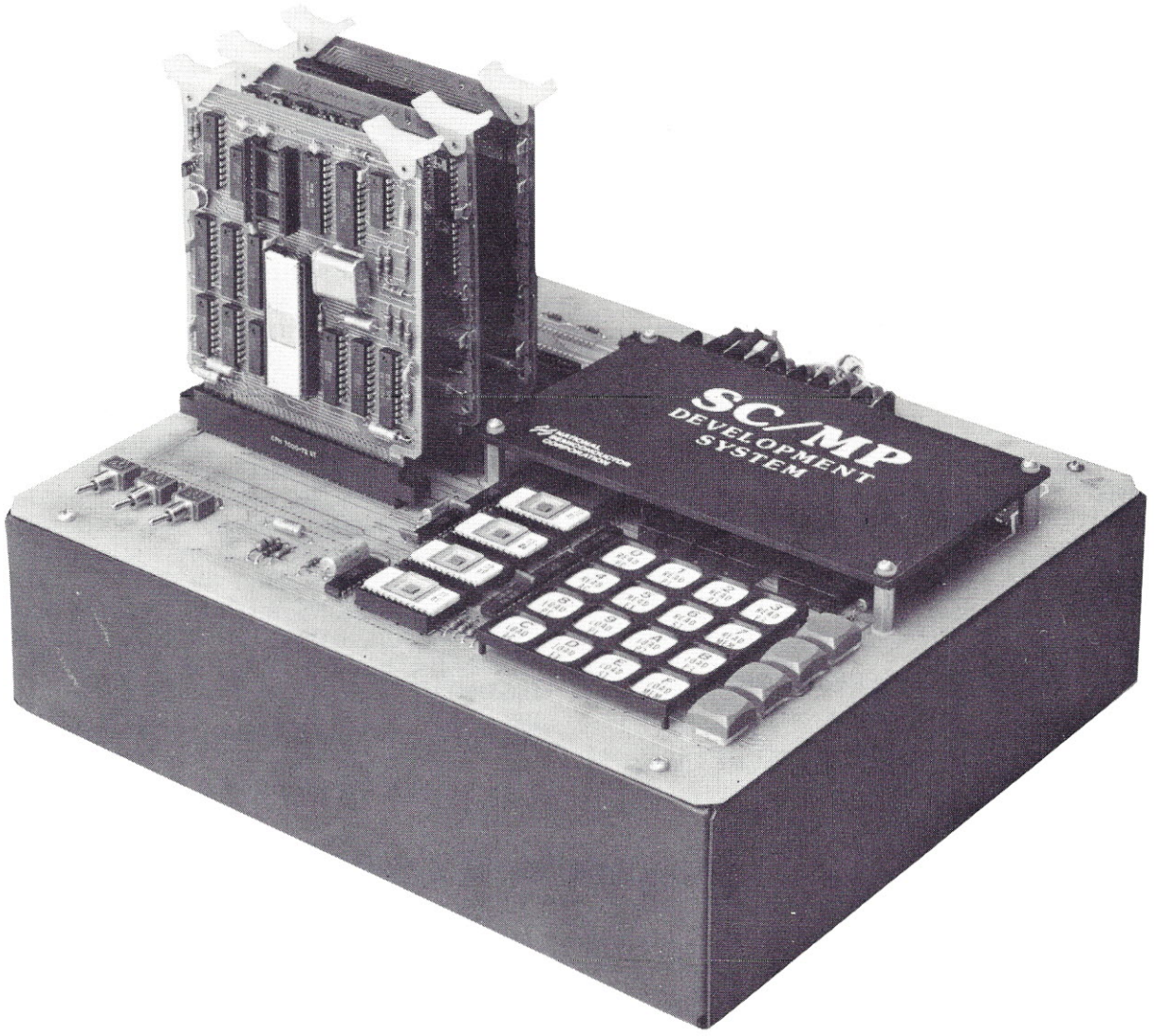


FIGURE 2

SC/MP LOW COST DEVELOPMENT SYSTEM (LCDS)

NIBL MINIMUM HARDWARE CONFIGURATION

NIBL was originally conceived to operate on the recently introduced SC/MP Low Cost Development System (LCDS). Thus it could be a handy bench (or garage) tool for anyone with an LCDS and a teletype or other terminal (Figure 2). During program development, however, it was determined that NIBL could actually be supported on the much simpler hardware configuration shown in Figure 3. Briefly, the minimum hardware required is:

- SC/MP CPU, crystal and support logic
- 110 Baud ASCII terminal interface
- 4K x 8 ROM for NIBL
- 2K x 8 RAM user space (allows about 60 average NIBL statements)
- TTY or similar terminal
- Power supplies (+5, −12 volts)

As an option, NIBL will presently support an additional 14K bytes for the user memory (RAM), giving a total capacity of around 760 average lines of NIBL code in 16K x 8 of RAM. Such a capacity is adequate for many control tasks as well as a large variety of presently available games. NIBL also offers the programmer "hooks" to machine language subroutines through the LINK statement. Thus, frequently used routines where a great deal of speed or bit manipulation is necessary can be translated into SC/MP object code and installed anywhere within the 64K address space of the SC/MP microprocessor. They can then be incorporated into and used by NIBL programs. In this manner quite large and complex program assemblages can be built up and controlled by NIBL.

NIBL APPLICATIONS

Most users sitting at a NIBL terminal for the first time will want to start playing games with the machine. There seems to be nothing like the thrill of having some quasilogical conversation with, and being soundly beaten by, a computer. TINY BASIC was originally built to implement games; and it performs well in this mode. An example of a simple NIBL

game which will illustrate the flavor of the language is shown in Figure 4. A selection of NIBL games will be released in early 1977 by Bob Albrecht of the People's Computer Company (PCC).

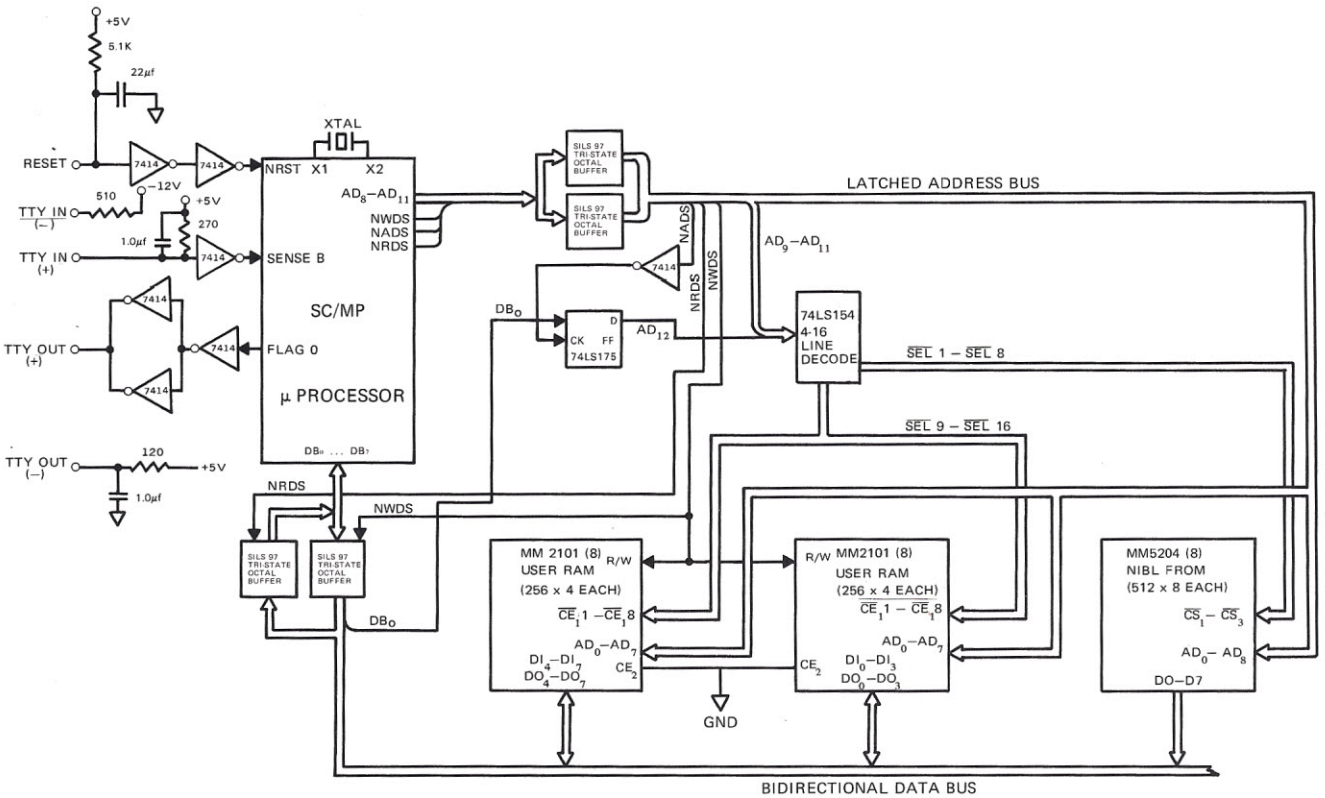


FIG 3. MINIMUM HARDWARE REQUIRED TO SUPPORT THE NIBL INTERPRETER

```
10 PRINT"                              BAGELS": PRINT"": PRINT""
40 PRINT" I WILL THINK OF A THREE DIGIT NUMBER.  YOU TRY TO"
50 PRINT" GUESS WHAT IT IS.  FOR EACH CORRECT DIGIT IN THE"
53 PRINT" CORRECT LOCATION, I WILL PRINT 'FERMI'.  FOR EACH"
55 PRINT" CORRECT DIGIT NOT IN THE CORRECT LOCATION, I WILL"
57 PRINT" PRINT 'PICO'.  IF NO DIGITS ARE CORRECT, I WILL PRINT"
58 PRINT" 'BAGLES'.": PRINT"": PRINT""
59 REM
60 A=RND(1,9):B=RND(0,9):C=RND(0,9):P=0
70                                     REM SELECT A NUMBER
71 REM
120 PRINT " PLEASE GUESS A THREE DIGIT NUMBER. ";
130 INPUT G:                           REM INPUT GUESS, TEST RANGE
135 REM
140 IF G>1000 OR G<100 GOTO 120
160 M=0: N=0: P=P+1: H=G/100:REM ZERO CNTRS, SELECT LEFT DIGIT
200 IF H=A M=M+1:                      REM CORRECT DIGIT & LOCATION
210 IF ((H=B)OR(H=C)) N=N+1: REM CORRECT DIGIT, BAD LOCATION
230 I=MOD(G,100)/10:                   REM SELECT MID. DIGIT OF INPUT
240 IF ((I=A)OR(I=C)) N=N+1: REM CORRECT DIGIT, BAD LOCATION
250 IF I=B M=M+1:                      REM CORRECT DIGIT & LOCATION
270 J=MOD(G,10):                       REM SELECT RIGHT DIGIT OF INPUT
280 IF ((J=A)OR(J=B)) N=N+1: REM CORRECT DIGIT, BAD LOCATION
300 IF J=C M=M+1:                      REM CORRECT DIGIT & LOCATION
```

FIGURE 4. "BAGLES" — A SIMPLE NIBL GAME

```
310 IF M<3 GOTO 600
320 PRINT" CONGRATULATIONS! YOU GOT IT IN",P,"TRIES."
330 PRINT" PLAY AGAIN?  (1=YES, 0=NO)"
340 INPUT Q: IF Q=0 GOTO 1000
360 GOTO 60
500 REM
550                              REM NEXT SECTION PRINTS CLUES
600 IF M<>0 FOR T=1 TO M:PRINT"FERMI  ";:NEXT T
620 IF N<>0 FOR T=1 TO N:PRINT"PICO  ";:NEXT T
650 IF M+N=0 PRINT "BAGLES"
700 PRINT"":GOTO 120:          REM ASK FOR NEXT GUESS
1000 PRINT"GOODBYE"
```

The object of the game is to guess the number that the microprocessor has picked. All numbers are between 100 and 999. For each correctly guessed digit in the correct location, the processor responds "FERMI." For each correct digit not in the right location, the processor responds "PICO." If no correct digits are guessed, the processor responds "BAGLES."

The NIBL language is well suited to control tasks, as long as the user recognizes its inherent speed limitations. While it is more than adequate for human interface and a variety of other control applications, it doesn't have the speed to handle video generation, direct control of fast peripherals, etc. For these applications, the algorithms should be proved out in NIBL, then translated into SC/MP machine code for installation in the final system. On the plus side, once the user has paid the initial price in speed and ROM for the interpreter, he will find that NIBL tasks (which are stored as powerful source statements) tend to take less memory than their assembly language equivalents. The larger the program, the more dramatic are the savings.

CONCLUSION

Microprocessor technology will change the ways that all of us live, by infusing high technology into our everyday activities. Whereas most people in this country today have never come in contact with microprocessors, soon each of us will make use of a variety of them every day. They will be in our cars, appliances, TVs, games, tools, etc. They will be ubiquitous; in five years you won't be able to pick up a hammer that doesn't have a microprocessor in it!

For processors to be so pervasive, they will have to penetrate non-traditional markets where simplicity of design, ease of programming, and early user confidence of success will be crucial. NIBL is one of the tools that should make the job easier. NIBL is available now in a preliminary form and will be supported by a new, self-teaching manual on NIBL and the SC/MP LCDS which is currently being written by Bob Albrecht and Don Innmann.

BIBLIOGRAPHY

DR. DOBB'S JOURNAL OF COMPUTER CALISTHENICS AND ORTHODONTIA; Volume 1, No. 1 — January, 1976. PCC, Box 310, Menlo Park, CA 94025

And thanks to Dr. Marvin Winzinread, California State University at Hayward, for "BAGLES."

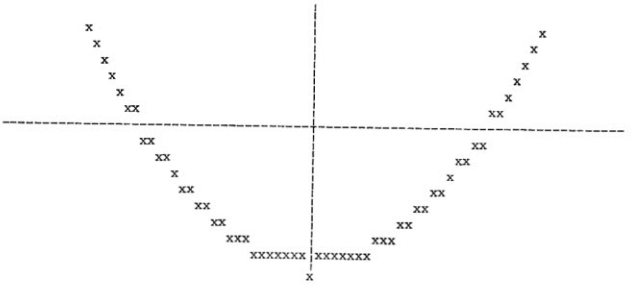
ABOUT THE AUTHOR

PHIL ROYBAL/BIO SKETCH

BsEE from UC Berkeley, 1968
1 year at HEWLETT PACKARD
Project Engineer
4 years at VARIAN DATA MACHINES — Microcomputer Sales, Applications and Marketing.
NATIONAL SEMICONDUCTOR CORP. — since 1973 as MP Product Marketing Mgr.
Associated With ACM.



VECTORED FROM PAGE 115



Display output for preceding program.

SPONSORSHIP

The development of the LLL 8080 BASIC Interpreter was performed under the auspices of the U.S. Energy Research and Development Administration, under contract No. W-7405-Eng-48.

CONTINUATION

Next month we will publish PART #2 — LLL 8080 BASIC Interpreter Source Program Without Float. At the completion of publishing this series at least a hard copy and hopefully a paper tape source copy will be made available from the Microcomputer Software Depository.

FIFO FLEA MARKET

PDP-8 MINI COMPUTER (Straight-8) for sale or trade. Mounted in attractive walnut cabinet (wife approved for den). Complete with maintenance manual, drawings, 4K Basic, 4K Focal, Editor, PAL III assembler, Disassembler, TTY interface, games, etc., etc. Perfect condition. Free DECUS membership available for additional software. Presently in use with ASR Model 33 teletype. Can be sold with or without teletype. Sale price w/o teletype $800.00. Rex Eagle, P.O. Box 10498, Charlotte, N.C. 28288. (704) 374-6557.

FOR SALE: TTY Paper Tape. 1 inch wide, 8 inch diameter rolls, buff, oiled. Perfect for ASR-33. $5.00 + UPS shipping per 7 roll carton (12 lbs) or $15.00 per 28 roll case + UPS. Two or more cases, $12.50 each + UPS. D. S. Parker, 1007 3rd St. No. 3, Davis, CA 95616. (916) 758-2341 after 5:00 p.m.

I WILL BUY your new, used, or dead Altair 8800, working or not, for cash. Am desperate for Altair; help out a poor college kid. Will also trade for your machine; have a scope and a teletype. Call anytime. Jim Webb, P.O. Box 5224, Carson, CA 90749. (213) 325-4684.

FOR SALE. All completely assembled and fully tested. ALTAIR 8800 with 5K RAM, PT 16-slot mother, MITS 4K BASIC on paper tape, fan; best offer over $700 takes it. SWTP CT-1024 with screen read, manual and computer cursor boards, 110-150-300-600-1200 baud SI/O, video monitor; best offer over $250. I'll allow $325 for your clean Micro-Term ACT-1 if you take it all. Bob Ripley, Route 3, Fayetteville, AR 72701. (501) 267-3172 after 5 CDT.

WANTED: Need Varian 620L or L-100, Contact Frank Jacobson, (714) 842-6439.

VIATRON SYSTEM 21 Boards No. 1 thru 7 Complete with LSI and only three known problems. (over 80% AOK) $125.00 Viatron Key Board $25.00. Viatron power supply $25.00. 8 level Friden paper tape punch $50.00. Paper tape reader $45.00 (both for $75.00). WB5BLX, 3728 Wilkie Way, Ft. Worth, TX 76133.

WANTED: A Hi-spd. computer terminal and or coupler (modem). Preferably a CRT. At least 12 lines and at least a 64 character line, preferably 80. ASCII. Full/half duplex coupler. Both CRT and coupler must be capable of 30 C.P.S. Under $800 for terminal. Write to: Mark Chapman, 7015 Tupa Dr., Edina, Mn. 55435.

HELP — anyone have info. on general computer terminal PT2900000. These were sold by ALTAJ several years ago. Need input/output info. J.P. Chalala, RD 1, Willow Street, PA 17584.

FOR SALE: Freiden Flexowriter Baudot Teletype with 5 level paper tape punch/reader plus card reader. Can be converted to ASCII. $95. J. Millenson, 64 The Uplands, Berkeley, Ca 94705. (415) 654-5538.

FOR SALE: Altair 8800 system w/8 K RAM, 88-SIOA, 88-ACR, 8 K BASIC — assembled and running: $1167. SWTP CT-1024 complete less monitor or case, unassembled: $275. Friden ASCII communications terminal from Herbach and Rademan with control unit: $200. Chris Foreman, P.O. Box 127, Reseda, CA 91335. (213) 342-8845.

FIFO FLEA MARKET ADS

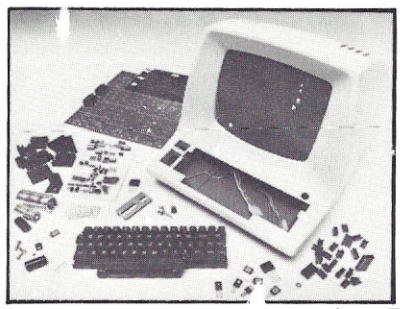
★ PERSONALS FREE ★

Max. 10 lines per ad. Submit Ads to: FIFO Ads—**INTERFACE AGE** Magazine, P.O. Box 1234, Cerritos, CA 90701.

Disc/3

COMPUTER MART

TURNKEY SOFTWARE SPECIALISTS



EASY

TO ASSEMBLE

Lear-Sigler ADM-3 terminal kit with NEW DCA (direct cursor addressing) 24 lines x 80 characters; 64 ASCII upper characters, plus punctuation and control; 5 x 7 dot matrix; EIA standard RS232C and 20mA current-loop (switch selectable).

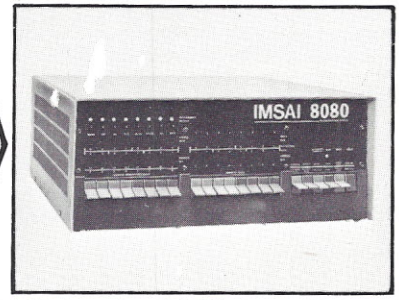
$849.95* with DCA

FAST

MICROPROCESSOR

IMSAI 8080 microcomputer, top of the line; rugged industrial quality; 28 amp power supply; 22 slot mother board; fully expandable to 64K; will support floppy disk drive, terminal, audio-tape cassette input device, 300 lpm printer.

$559.95*



Look to DISC/3...authorized distributors for IMSAI, Lear-Sigler, Cromemco, Z-80, Centronics Data Computer, Digital Equipment Corp., and Data General Corp.

Disc/3 DISC/3 1840 Lincoln Blvd., Santa Monica, Calif. 90404
Store hours — Monday-Friday 8:30-5:30 by appointment only

RUSH ORDER FORM — or Call Disc/3 (213) 451-8911

	KIT*	ASSEMBLED	TOTAL
ADM 3-K with DCA (24 x 80)	$849.95	$1099.95	
IMSAI 8080 microsystem	$559.95	$ 899.95	

Californians please add sales tax

Enclosed is my ☐ cashiers check, ☐ money order, ☐ personal check, ☐ $100 deposit for C.O.D. Signature

☐ BankAmericard NO. Expires

☐ Master Charge NO.

BANKAMERICARD

NAME ADDRESS

CITY STATE ZIP

we honor master charge THE INTERBANK CARD

CIRCLE INQUIRY NO. 67

FOR SALE OR TRADE: Two signetics 3000-series Bit Slice 8-bit development kits, *each* containing 1-3001 MCU, 4-3002 CPE, 1-74S182, 1-8T31, 2-8T26A, and 3-82S114 256x8 PROM. Normally sells for $100/ea. Information on a PDP-11 emulator using these chips is available. S.L. Diamond, P.O. Box 22428, San Francisco, CA 94122.

FOR SALE: CRYPTOGRAPHIC PROGRAM that will baffle the codebreakers of the CIA. ENCODE and/or DECODE your private correspondence for maximum security. Documentation of cypher technique, program listing and punch paper tape in BASIC for only $6. JON STEDMAN, 1528 Summit Rd., Berkeley, CA 94708.

FOR SALE: INTEL 3000 series chips — Shottky Bipolar Microcomputer chip set. Includes 10-3002's, 2-3001, 10-3601 (256x4 PROM), 3212, 3003, 3226, 3214. Two books documentation, data sheets. All unused, bought new for $400. Asking $250 or best offer. David Bright (301) 530-2890. 4809 Broad Brook Dr., Bethesda, Md. 20014.

Model 35 KSR's; The heavy duty version of the light duty 33 KSR; Friction or Sprocket feed -100 WPM 20 or 60 Mil serial interface.; 1973 ASCII — Even Parity keyboard; Doug (714) 747-0374. Ron — evenings (213) 377-5822.

SWAP OR SELL: SWTP CT-1024 TVT II with Serial I/O, Manual Cursor, Screen Read, P/S. ALTAIR 8080 CPU board. Tarbell Cassette interface. HAL ST-6 Teletype converter with all options (Can be used as a Modem). All in like new condition and guaranteed perfect. Need Hard-copy printer or ??? Michael Shrayer, 930 So. Bonnie Brae St., No. 331, Los Angeles, Ca 90006. (213) 380-6509.

FOR SALE: Pacer; a 16 bit micro w/TTY interface, line assembler (in ROM) and complete documentation. Assembled and running in cabinet w/32 key control assy. (213) 243-5179 or Box 430, Glendale, CA 91206.

FOR SALE: Hewlett-Packard 170 B Oscilloscope. DC to 30 MHZ. Triggered sweep in 24 ranges. With dual trace vertical plug-in and new delayed sweep horizontal plug-in. $350. Equipment was manufactured for the U.S. Government and is in good working condition. S. Schreiner, 8719 E. Coronado Rd. Scottsdale, AZ 85257.

WANTED: One set P C Boards for MOD-8, and Monitor-8. Preferably unpopulated. Jerry Walker 761 Clayton, San Francisco, Ca. 94117.

MOS TECHNOLOGY KIM-1 software program including vowel game, binary to BCD routine, and a chaining routine which permits tape load directly to CRT terminal or TTY and up to 1K active program load at the same time. J. Baker 14N Village Green, Budd Lake, N.J. 07828. Send $4.95

WANTED: Anyone having any information or schematics of u Pac Logic Cards. I am willing to pay reasonable price for same. Send to John A. MacDonald, P.O. Box 5880, Baltimore, Md. 21208, (301) 484-6382.

WANTED: MICRO/MINI transportable in auto. Minimum: CRT or printer, CPU with 16K available (8K with packed data might do) plus high level language or assembly language, power supply 120vAC, cassette memory, keyboard. Objective: A unit to give demonstrations in potential clients' offices. Bill Hitchins, (213) 697-1510.

FOR SALE: Two MITS 4k Dynamic Memory Boards. New — Assembled and used for 1 month. $190 each, $375 for both. Bob Chase 11911 Weddington, N. Hollywood, CA 91607. (213) 763-3030 Eves.

WANTED: Manuals for RCA Flexiterm Data Display terminal, model FDD-I, s/n 1043 (Sperry Rand 752 Video Data Terminal). Need Maintainance Manual #70-01-752-U and Symbolic Logic Package Manual #g2149850-U and revisions. Contact: D. Penunuri, 2130 W. Crescent Ave., #2149, Anaheim, CA 92801, (714) 632-0663.

MICROSWITCH KEY BOARD: 40+4+space bar, keys. Special code, circuit board can be removed for recoding. Specify with or without circuit board either way. $14 postage paid. Sent UPS. Monte Zink, 4987 Mt. Hay Dr., San Diego, CA 92117, (714) 278-7328.

FOR SALE OR TRADE: MFE model 250 digital cassette drives, 10 i ps, 800bpi, w/case, new. Offer. John L. Marshall, Box 242, Renton, WA 98055, (206) 226-7775.

FOR SALE: CMod80 — Includes CPU (with Prom monitor), 2K RAM, Parallel-Serial 10, $150 RPC-4000, $500. Call Sam Ulin (302) 475-7355.

ADVANCED ★MICROCOMPUTER PRODUCTS

BUILD YOUR OWN COMPLETE COMPUTER SYSTEM



★ AMI EVK 99 6800 BASED MICROCOMPUTER

Ask the Home-Brew Computer Club in Santa Clara, California why they choose the EVK 99 Microcomputer. They now have 85 systems. The reasons are clear: Performance, versatility and cost effectiveness. Photo is of expanded EVK 99 Board.

Photo of expanded EVK 99

$159.95

1. EVK 99 consists of the following only
Qty. (1) PCB 10½ x 12
(1) 6800 8 bit CPU
(1) 6850 ACIA (Asynchronous Communication Interface Adapter)
(1) 6820 PIA (Peripheral Interface Adapter)
(2) 6830 ROM Subroutine Program Library (1) 6831 1K ROM
(4) 6810 1 RAM
(1) Operating Manual & Instructions
To implement fully expanded system additional IC's are required. (See Photo)

2. UNIVERSAL KLUGE BOARD $98.00
Completely compatible to the EVK system. This board allows the user to add any additional parts he desires. It has 5400 holes, holds 94 16 pin IC's or others on .2, .4, .6, .9" or greater centers. 2 - 50 pin, 1 - 20 pin flat cable, 1 - 25 pin RS232 connector.

3. 16K BYTE RAM BOARD $77.95
16K x 8 or 8K x 16 organization. Uses 2102's or 211.02's and adapts to slow memory.

4. 6 SLOT MOTHER BOARD $29.95
Connectors mount on .75" centers. May be plugged together for expanded applications.

5. EXTENDER BOARD $46.50
For use with back plane above in card cage configuration.
New boards are now in development including cassette I/O and others. If you want more information drop us a line.

TV GAME KITS

Qty (1) GI AY38500 1 TV Game Chip ONLY $29.95

TV KIT NO.1 ONLY $34.95
Includes AY38500 1 TV GameChip PC Board for video composite output plus instructions. Add $5.95 for 2MHz crystal.

TV KIT NO. 2 ONLY $49.95
Includes AY38500-1 TV GameChip, PC Board, Switches, pots, speaker, crystal, XFMR, Bridge and all parts required for video composite. Works super with terminal. Includes instructions and data sheets.

TV KIT NO.3 ONLY $59.95
New design utilizes the AY38500-1 GameChip which features Hockey, Tennis Practice and Pong. Modular design includes chassis, and all necessary parts to assemble complete game with RF output. Kit comes complete with instructions and data sheets.
Send $1.00 for complete information package (refundable with purchase)

RF MODULATOR MODULE
To convert your video composite to RF try UM 1021 Channel 3/4 VHF Modulator $8.95
● DC Switchable VSWR = 2 max VCC = 6.5 volts
● DC Coupled modulation input with positive transfer characteristic.
Designed for use with TV Games.

★ MICROPROCESSOR PRODUCTS

8080A/9080A	$24.95	S6860	$15.95	21L02/91L02	1.99
AMI S6800	24.95	S6820	11.00	2102/9102	1.89
AM2901	29.95	S6810-1	6.25	9131/2111	4.75
GI CP1600	69.95	S6850	10.95	9101/2101	5.25
Z80	69.95	S2350	12.95	9112/2112	2.95
6502	29.95	S1883	5.90	7489	1.88
AM2902PC	$ 3.95	S6834-1	22.95	4104/4804	12.95
AM2905PC	10.95	S6800 Programming Manual	15.00	4402A	12.95
AM2906PC	11.95	S6800 Hardware Manual	15.00	4200	12.95
AM2907PC	10.75	Tony Bate Spacer tape	22.95	9131APC	14.95
AM2909PC	24.95	On 6834 1 Prom	175.00	9141APC	14.95
AM2911PC	18.95	8212 $ 4.75	AM2533 7.50	9050/TMS4050	12.95
AM2918	6.75	8224 6.25	AM2401 16.50	9060/TMS4060	12.95
AM2920PC	7.95	8216 4.95	AM1402 6.95	P3101	3.25
AM2921PC	7.95	8226 5.95	AM1403 5.95	5101	11.95
AY 5-1013A	5.50	8228 9.90	AM1404 6.95	1702A	10.90
AM2812	14.95	9561 19.95	MM5604H 2.25	2708	68.00*
AM2841	12.00	9555 19.95	MM5616H 4.95	5204	23.50
AM3341	9.95		AM3347 6.40		

SPECIALS

75452	10/2.50
8T26B	2/5.00
74LS138	1.49
8097	.99
74166	.80
74161	.49
741HC	10/2.50
MH0026CN	3.95
1488	1.29
1489	1.29

★ NEW PRODUCTS

NEW FROM NEC Microcomputer! FIRST TIME OFFERED

D372 Floppy Disc Controller Chip	$125.00
D371 Mag. Tape Cassette Controller Chip	99.95
Application Notes (26 pages)	6.95
GI AY3550 4½ Digit DVM Chip	29.95
GI AY3600 Keyboard Encoder	9.95
Intersil 8038CC	4.95
XR2263 Servo Cont.	6.95
RO 32513 Char Gen	9.95

★ IC MARKET PLACE ★

★ LINEAR

LM105	3.50	LM320K-5.2	1.45	LM381N	1.79
LM106H	2.50	LM320K-12	1.45	LM382N	1.79
LM300H	.80	LM320K-15	1.45	LM555CN	.58
LM301H	.45	LM320T-5	1.75	LM556CN	1.30
LM301CN	.45	LM320T-5.2	1.75	LM567CN	1.45
LM302H	1.25	LM320T-8	1.75	LM565N	1.95
LM304H	1.20	LM320T-12	1.75	LM565H	1.95
LM305H	.85	LM320T-18	1.75	LM703CN	.45
LM305AH	1.25	LM232K-5	9.95	LM709H	.40
LM306N	.95	LM324M	1.65	LM709N	.40
LM307CN	.35	LM339N	1.55	LM710N	.70
LM307H	.35	LM340K-5	1.95	LM711N	.39
LM308H	1.00	LM340K-8	1.95	LM711H	.39
LM308CN	1.00	LM340K-12	1.95	LM723N	.55
LM309H	1.10	LM340K-15	1.95	LM723H	.55
LM309K	1.25	LM340K-18	1.95	LM725H	3.25
LM310CN	1.15	LM340K-24	1.95	LM733N	1.00
LM310H	1.15	LM351CN	.65	LM733CH	1.45
LM311H	.90	LM370N	1.65	LM739N	1.29
LM311CN	.49	LM370H	1.65	LM741CH	.35
LM312H	1.95	LM373N	3.25	LM741CN-14	.39
LM318H	1.50	LM377N	4.00	LM741CD	.49
LM318CN	1.50	LM380N	1.39	LM747H	.75
LM319N	1.30	LM380CN	1.05	LM747N	.75
LM320K 5	1.45			LM748H	.39
				LM748N	.39

LM1414N	1.75	75324	3.50		
LM1458CN	.65	SG4501T	2.40		
LM1496N	.95	SG4501N	2.40		
LM2111N	1.95	SG3524	8.95		
LM2901N	1.95	RC4194T	6.95		
LM3065N	.69	RC4195T	6.95		
LM3900N	.55	RC1458CN	.89		
LM3909	1.10	RC1556CN	.99		
LM7520	2.25	RC3403AD	2.30		
LM7524N	1.75	RC4131CN	.99		
LM7525N	1.90	RC4136D	1.90		
LM7534N	2.20	RC4558CN	.99		
LM7535N	1.25	RC4151CN	6.50		

★ CMOS

CD4000	.25	CD4026	1.95	CD4075	.35
CD4001	.25	CD4027	.85	CD4078	.35
CD4002	.25	CD4028	1.50	CD4081	.35
CD4006	1.75	CD4029	1.99	CD4082	.35
CD4007	.25	CD4030	.60	CD4510	1.95
CD4008	1.95	CD4033	2.49	CD4511	1.40
CD4009	.48	CD4034	4.95	CD4516	1.95
CD4010	.48	CD4035	1.79	CD4518	2.45
CD4011	.28	CD4040	2.10	CD4520	2.49
CD4012	.28	CD4042	1.45	CD4522	2.56
CD4013	.60	CD4043	1.45	CD4526	2.56
CD4014	1.95	CD4044	1.95	CD4527	2.70
CD4015	1.95	CD4049	.61	CD4528	1.50
CD4016	.59	CD4050	.61	CD4531	1.99
CD4017	1.25	CD4051	2.25	CD4543	2.25
CD4018	2.39	CD4066	1.20	CD4555	1.75
CD4019	1.95	CD4068	.35	CD4556	1.75
CD4020	1.35	CD4069	.35	CD4581	4.95
CD4021	1.85	CD4070	.99	CD4582	1.95
CD4023	.29	CD4071	.35	CD4585	2.45
CD4024	1.29	CD4072	.35	Also	
CD4025	.29	CD4073	.35	5101	$11.95

★ 7400 TTL

7400N	.18	7445N	.99	74122N	.44
7401N	.18	7446N	.99	74123N	.60
7402N	.18	7447N	.99	74125N	.79
7403N	.18	7448N	.99	74126N	.79
7404N	.19	7450N	.26	74132N	.70
7405N	.20	7451N	.26	74141N	.88
7406N	.25	7453N	.26	74145N	.70
7407N	.25	7454N	.26	74147N	$1.59
7408N	.21	7470N	.45	74148N	$1.29
7409N	.21	7472N	.30	74150N	$1.15
7410N	.21	7473N	.30	74151N	.98
7411N	.21	7474N	.30	74153N	.98
7412N	.21	7475N	.69	74154N	$1.15
7413N	.45	7476N	.42	74155N	.95
7414N	.89	7480N	.70	74156N	.95
7416N	.35	7482N	.95	74157N	.95
7417N	.35	7483N	.95	74160N	.99
7420N	.19	7485N	.89	74161N	.99
7421N	.35	7486N	.28	74162N	.99
7422N	.35	7489N	$1.88	74163N	.99
7425N	.35	7490N	.60	74164N	.99
7426N	.35	7491N	.70	74165N	.99
7427N	.35	7492N	.59	74166N	$1.10
7428N	.28	7493N	.79	74170N	$4.20
7430N	.21	7494N	.79	74172N	$16.25
7432N	.21	7495N	.79	74173N	$1.40
7433N	.30	7496N	.79	74174N	$1.25
7437N	.35	7497N	$3.75	74175N	$1.25
7438N	.35	74100N	$1.10	74176N	.79
7440N	.21	74104N	.53	74177N	.79
7441N	$1.05	74105N	.53	74180N	.79
7442N	.69	74107N	.33	74181N	$2.75
7443N	.69	74109N	.33	74182N	.79
7444N	$1.50	74121N	.35	74184N	$2.10

100 PIECES MIX TAKE 10% DISCOUNT
1000 PIECES MIX TAKE 15% DISCOUNT

ALTAIR /IMSAI COMPATIBLE 8K MEMORY

Our new brain board comes complete with 21L02-1 memory chips (500ns) and sockets.

All address control and data out lines fully buffered.

THE SAME 8K BOARD OFFERED TO THE SCCS GROUP PURCHASE. NOW OFFERED TO YOU AT THE SAME LOW LOW PRICE!

$198.00 COMPLETE

If you desire 91L02APC - Please add $9.95

EIGHT LEVEL PRIORITY INTERRUPT CPU, ALTAIR/IMSAI 8080 COMPATIBLE

FEATURES
1. Designed for operating with- out front panel.
2. Power on memory jumps (to users program)*
3. 8224 Clock driver
4. 8214 Interrupt controller
5. Memory write
6. Pull up on all inputs
7. Status/Data lines buffered and latched
8. Address lines tri stated

*Programs Available on PROM's

SPECIFICATIONS
CPU: Intel 8080A or AM9080ADC
CYCLE: 2 Sec/Instruction
ADDRESS: Up to 64K Bytes
I/O: 256 Directly Addressed
INTERRUPT: 8 Level Priority Vectored Interrupt
POWER: 7.5 to 10VDC, 0.7A 15 to 20VDC, 60MA
PRICE: 101C Kit $129.00; 101G Assembled 179.00

6800 STARTER SET

Only 68 Bucks $68.00
You Get (1) 6800 8 bit CPU
(1) 6820 PIA
(1) 6850 ACIA
(16) 2102 RAM's

Add $15.00 for AMI 6800 Programming Manual

8080A STARTER SET

Only $80.00
You Get (1) 8080A 8 bit CPU
(1) 8212 I O Port
(1) 8224 Clock
(1) 8228 System Controller
(24) 2102 RAM's

Add $5.95 for MCS 8 8080 Users Manual

PLESSEY SEMICONDUCTORS

RADIO COMMUNICATION

SL610C	1.95	SL624C	2.75
SL611C	1.95	SL630C	1.95
SL612C	1.95	SL640C	1.95
SL6 °C	2.40	SL641C	6.95
SL620C	2.55	SL645C	5.95
SL621C	2.55	SL650C	5.75
SL622C	2.95	SL651C	4.95
SL623C	2.95	SL680C	3.75

Application Manual for SL600 Circuits 1.95
Plessey Semiconductor Catalogue 3.95

DIVIDERS

SP8600B	6.95	SP8620B	12.50	JP8640B	6.20
SP8601B	4.25	SP8621B	8.50	PS8641B	7.50
SP8602B	16.00	SP8622B	6.50	SP8642B	12.50
SP8603B	14.50	SP8630B	20.00	SP8643B	20.00
SP8604B	8.25	SP8631B	12.00	SP8646B	6.50
SP8607B	17.00	SP8632B	10.00	SP8647B	8.00
SP8613B	17.50	SP8634B	35.00	SP8650B	25.00
SP8614B	18.00	SP8635B	27.50	SP8651B	18.50
SP8615B	20.00	SP8638B	22.50	SP8652B	12.00
SP8616B	22.00	SP8637B	18.00		

FCN GEN KIT $18.50
63 Key Keyboard 19.95
19 Key Keyboard 11.95

Also . . . we stock entire continental specialties line new sockets and bus strips for microprocessor design

Experimenter 600 (.6 spacing) $10.95
Experimenter 300 (.3 spacing) 9.95

All shipments first class or UPS in U.S. or add 5% for shipping and handling. Minimum order $10.00. California Residents add 6% tax. Foreign add 8%.

ADVANCED ★MICROCOMPUTER PRODUCTS
P. O. BOX 17329
IRVINE, CALIFORNIA 92713
PHONE (714) 968-3655

★ ORDER YOUR NEW CATALOG NOW !

CIRCLE INQUIRY NO. 68

Merry Christmas

MICRO-MARKET

MICRO-MARKET AD RATE: $25.00 per column inch. Max. 4 column inches per ad. Submit ads to Micro-Market Ads—INTERFACE Magazine, P.O. Box 1234, Cerritos, CA 90701.

I F Y O U M E A N B U S I N E S S

USE YOUR MICRO-SYSTEM AS INTELLIGENT TERMINAL @ 110/300/1200 BAUD FOR TELEPHONE DIAL-UP; ON-LINE OR REMOTE JOB ENTRY USING OUR FREE PROGRAM LIBRARY WITH EXPLICIT MANUALS, SELF-GUIDING DATAENTRY FOR FAST ORDER-TAKING,INVOICING,INVENTORY CONTROL,JOBSCHEDULING,ENGINEERING DOCUMENTATION. 1200 BAUD RJE OVER DIALUP LINES ECONOMICAL CROSS-COUNTRY. WE SELL ALSO COMMUNICATION ADAPTERS, FLOPPIES, CASSETTES ETC. WRITE FOR SPEX & INFO !
(213)596-4491 BA OR MC CREDIT CARD
3431 CERRITOS,LOS ALAMITOS CA 90720
Q U I K D A T A - T I M E S H A R I N G

End your video display problems quickly with a "PIXE-VERTER"

A transistorized modulated oscillator which instantly converts a TV receiver into a top notch video monitor. Connects directly to antenna terminals. No wiring modifications required to the set. Operates on channels 2-6. Power requirements 5-6 volts @ 3 ma. Ideally suited for computers, electronic games, TV cameras, video recorders, etc. Size: 1.25" x 2.1". Kit model #PXV-2A $8.50. Order by phone or mail.

DIAL 402-987-3771

ATV Research 13-I BROADWAY DAKOTA CITY, NEBR. 68731

GI AY3-8500 TV Game Chip . . 39.95
■ with PC Board . 42.95
■ Videoout Kit . . 59.95
AMD 8080A Chip Set 79.95
Consists of ■ (1) AMD 8080A
■ (32) 91L02APC
91L02APC $1.95
Send for Free Catalogue
Advanced Microcomputer Products
P.O. Box 17329, Irvine, CA 92713

Happy Holidays

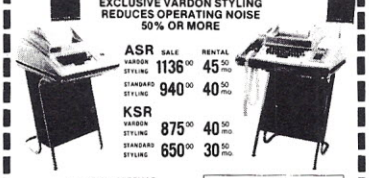
THE COMPUTER CORNER
"Brains are our business"
✳ *IMSAI 8080, POLY-88, PROC. TECH,*
✳ *Books, mags, tty supplies, brain games*
Hours: 10-6PM daily and Sat; Thurs. 10-9PM
White Plains Mall — 200 Hamilton Ave.
White Plains, New York 10601
Tel: (914) 949-DATA

Computer Mart of New York Inc.
314 Fifth Ave. ★ New York, N.Y. 10001
Microcomputers, Books, Components, Parts
Authorized Dealer—Service—Friendly Advice
Open 10-6 PM Mon-Sat
10-9:30 PM Thurs Eve.
STAN VEIT, Storekeeper
Telephone (212) 279-1048

COMPUTER HOBBYISTS!
Nationwide Classified Advertising Newsletter
Buy & Sell Hardware & Software
new/used/unique/low-cost
$3.75 for 18 issues.
Free sample issue on request.
ON_LINE Newsletter
24695 Santa Cruz Hwy, Los Gatos, Ca. 95030

TELETYPES $800
Model 33 ASR • Newly refurbished
RS232 • full/half duplex
30 day warranty
THE MULL COMPANY
920 Laurel Avenue
Menlo Park, CA 94025
(415) 327-7509

SERIES 33 TTY's FOR SALE OR RENT
EXCLUSIVE VARDON STYLING REDUCES OPERATING NOISE 50% OR MORE



		SALE	RENTAL
ASR	VARDON STYLING	1136.00	45.50/mo
	STANDARD STYLING	940.00	40.50/mo
KSR	VARDON STYLING	875.00	40.50/mo
	STANDARD STYLING	650.00	30.50/mo

OPTIONAL SPECIALS

w/Acoustic coupler	add $6/mo
W/Hard w/re modem (2 w/re)	add $8/mo
W/EIA RS-232	add $3/mo
W/Q.E.C. or Nova interface	add $4/mo
W/DCD Originate Auto Answer modem	add $22/mo
W/TWX/DDD modem	add $25/mo

TERMS
1. Prices guaranteed for term of lease.
2. All equipment F.O.B., Dallas, Texas
3. All equipment unconditionally guaranteed for 30 days.
4. Customer must provide maintenance after 30-day warranty period.

GET COMPLETE DETAILS WITH A DIRECT CALL:
(214) 252-7502 • TWX 910-860-5761 • TELEX 73-0022
vardon & associates, inc.
930 N. Beltline Road ■ Irving, Texas 75061
A subsidiary of Pioneer Texas Corporation

ELIMINATE INTERFERENCE!
Compact power line filter keeps line interference out of your system. Bonus! Keep your system noise from interfering with neighborhood TV, FM and AM receivers. Wire directly into Teletype, Computer, Terminal or Power Supply. Complete installation instructions. ☆*Only $8.95 Postpaid.*
Electronic Specialists, Inc.
171 So. Main, Natick, Mass. 01760
(617) 655-1532

ATLANTA COMPUTER MART
IMSAI Dealer
Kits • Accessories • Supplies • Books
Atlanta Computer Mart
5091-B Buford Hwy, Atlanta, GA 30340

SOUTH FLORIDA
Sunny Computer Stores, Inc.
Authorized Dealer:
IMSAI, Southwest, Cromemco, CSC, Vector and others
Books, Magazines, Newspapers, Service and Supplies
University Shopping Center
1238A South Dixie Highway
Coral Gables, Fla. 33146
(305) 661-6042



A.D.M. Communications, Inc.
Teletype & Communications Equipment
Buy—Sell—Recondition
1322 Industrial Ave.
Escondido, CA 92025
(714) 747-0374 Telex. 695097

ELIMINATE INTERFERENCE! Compact power line filter keeps line interference out of your system. Bonus! keep your system noise from interfering with neighborhood TV, FM and AM receivers. Wire directly into Teletype, Computer, Terminal or Power Supply. Complete installation instructions.
☆*Only $8.95 Postpaid.*
Electronic Specialists, Inc.
171 So. Main, Natick, Mass. 01760
(617) 655-1532

LONG ISLAND
IMSAI Dealer
COMPUTER MICROSYSTEMS
Kits • Parts • Service • Books • Magazines
1309 Northern Blvd., Manhasset, N.Y. 11030
Telephone (516) 627-3640

ADVERTISING INDEX

Information Inquiry Number		Page
MANUFACTURERS		
7	Apple Computer	11
14	Associated Electronics	26
15	Comptek	26
4	Cromemco	7
21, 39	Continental Specialties	39, 63
31	Cybercom	10
2	Digital Group	3
65	El Camino	CIV
	Hal Communications	59
16	iCOM	27
	IMSAI	54, 55, 62, CIII
5, 6	Iritelligent Systems	8, 9
35	Matrix Publishers	59
13	Miniterm	25
42	MPI	67
30	National Multiplex	53
	National Semiconductor	30, 31
19	National Terminal	37
25	North Star Comps	47
41	Ohio Scientific	67
20, 24	Parasitic Engineering	37, 45
22	Polymorphic Systems	41
8, 9, 10, 11	Processor Technology	16, 17, 18, 19
36, 37	Quay	60,61
1	Southwest Tech	CII
12	Sphere	23
43	Tarbell	71
27, 28	Technical Designs Labs	50, 51
26	Vector Graphics	49
33	Veras-F8	57
3	Wavemate	5
29	WWW Enterprises	52
23	Xybek	43
SURPLUS DEALERS		
52	Atwood Enterprises	83
60	Babylon	105
61	Digikey	107
63	Integrated Circuits	111
64	SD Sales	116, 117
68	Semicomp	126
66	Quest	121
COMPUTER RETAILERS		
40	A-VID	64
51	Bits & Bytes—Phoenix	83
62	Bits & Bytes—Fullerton	109
53	Byte Shop, Inc.	87
54	Byte Shop—Pasadena	91
47	Byte Shop—NY	75
56	Computer Components	97
49	Computer Enterprises	79
59	Computer Faire	101
44	Computer Mart of NY	72
55	Computer Store	81
48	Computer Systems Unlimited	77
67	Disc 3	125
50	Montana Comp.	93
56	MPU Shop	95
45	Sunnysound	72
46	Sunshine Comp. Co.	74
58	Ximedia	99

CAST YOUR VOTE

The authors in this issue would like to know your feelings as to which article you consider the best. You may cast your vote on each article or only one, which ever you prefer. The articles are graded on point scale 1 (lowest) to 10 (highest). At the end of the voting period all votes will be tallied and the highest scoring article will be announced and the author will receive $100 bonus.

NOTE: Use Original "Voting and Reader Service Card" only. Any other form is not acceptable.

ARTICLE	READER SERVICE VOTING NUMBER LOWEST		HIGHEST
iCOM's New Microfloppy *By Larry Courtney*	151	—	160
The Technico Super Starter Kit *By Terry Dollhoff*	161	—	170
The Hardcopy Revolution *By Simon Harrison*	171	—	180
Relative Address Back-Stepper *By J. Huffman*	181	—	190
Exhaustive Memory Testing *By T. E. Travis*	191	—	200
Text Editor For The SWTPC-6800 *By M. Borgerson*	201	—	210
Dr. Wang's Palo Alto Tiny Basic *By Roger Rawskoub*	211	—	220
LLL 8080 Basic Interpreter *By J. Barber and R. Eckard*	221	—	230
NIBL — National's Tiny Basic *By Phil Roybal*	231	—	240

Experience the excitement of owning the finest *personal* computer – IMSAI 8080

Waiting for you — all the incredible performance and power of the IMSAI 8080. And at a price you would normally pay for a home music system: $599 in kit; $931 assembled.

WORLD OF USES

The IMSAI 8080 is a superbly engineered, quality computer. It is versatile, expandable and powerful, putting literally hundreds of applications and uses at your fingertips. Imagine sitting at your desk and enjoying interaction with your IMSAI 8080! Press the *on* switch and you're ready for game playing, research, education, business applications, or for laboratory instrument control. It has all the power you need, and more, to make your application ideas come alive.

GROWS WITH YOU

The IMSAI 8080 is designed for many years of pleasure. With its open-chassis engineering you can expand your system by adding peripherals and interfaces. The 22-slots and 28 amp power supply mean that you can plug-in today's, plus *tomorrow's* modules.

Right now you can add a module for displaying color graphics and characters on TV; a ready-to-use keyboard; small and large printers, and a single interface that lets you attach multiple devices including a cassette tape recorder. Expect the latest, exciting equipment from IMSAI. We are committed to leadership in this expanding technology.

EASY TO PROGRAM

With our BASIC language you can operate the IMSAI 8080 quickly and easily. Technically knowledgeable? Use our assembly language to develop sophisticated and unique software.



If you're thinking personal computer, treat yourself to the very best – IMSAI 8080

Send for free four-color brochure or $1 for catalog. Call or write for name of nearest dealer.

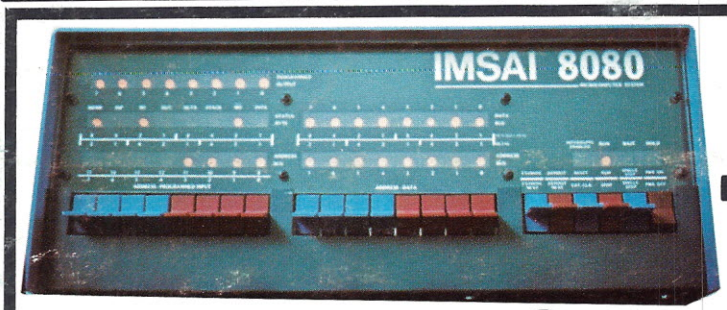
IMSAI

IMSAI Manufacturing Corporation
14860 Wicks Blvd.
San Leandro, CA 94577
(415) 483-2093
TWX 910-366 7287

ULTRABYTE

☆ PRESENTS ☆

THE FORMULA FOR POWER



+ Z-80

CPU BOARD

= IMSAI Z-80

THAT'S RIGHT! THIS ULTRA-POWERFUL COMBINATION IS OFFERED BY ULTRABYTE, ALONG WITH THESE OTHER CHRISTMAS SPECIALS

PLEASE RUSH ME THE FOLLOWING:

☐	*IMSAI 8080 Standard Kit, (without Standard CPU Board) with Powerful Z-80 CPU Board	$ 749.00
☐	*Same as above (IMSAI plus Z-80), but with 22 Slot Mother Board	$ 799.00
☐	IMSAI 8080 Kit, Standard	$ 499.00
☐	IMSAI 8080 Kit, with 22 Slot Mother Board	$ 545.00
☐	With all 22 Connectors, add $80.00	$ 625.00
☐	Card Guides, 20 pairs	$ 20.00
☐	IMSAI 8080 Kit, with pre-soldered 22 Slot Mother Board Containing all 22 Connectors	$ 700.00
☐	IMSAI 8080, Standard Assembled	$ 829.00
☐	IMSAI 8080, 22 Slot Mother Board, with all 22 Connectors, Completely Assembled and Tested	$ 995.00
☐	4K Bytes Static Memory, Kit	$ 129.00
☐	Assembled	$ 231.00
☐	ICOM's Frugal Floppy, including Disk Drive, CF 360 Controller, all Cables and Connectors	$1129.00
☐	ICOM's Frugal Floppy, same as above, but with Dual Disk Drive	$1749.00

SUB-TOTAL _____

OFFER EXPIRES JAN. 14, 1977

*CREDIT CARD ORDERS MAY BE MADE BY PHONE

*CALIF. RES. ADD 6% SALES TAX.
*CREDIT CARD USERS ADD 3% SERV. CHARGE
*SHIPPING CHARGE: COLLECT F.O.B. FACTORY

Enclosed Check or Money Order
For $ _____
Bankamericard No. _____
Mastercharge No. _____
Interbank No. _____
Signature: _____

Name: _____

Address: _____

City, State, Zip: _____

UltraByte Incorporated
P. O. Box 370, Westminster, CA 92683
(714) 892-4679

(Send Self-addressed, stamped envelope for complete computer accessory listj)

ADVERTISEMENT COURTESY OF GO FOR IT GRAPHICS, BOX 532, MANHATTAN BEACH, CA 90266
CIRCLE NO. 65 ON INQUIRY CARD